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SETTLEMENT CAPABILITY STUDY
For
The Hamilton-Wentworth Region

February 1976 VOLUME 1

ERRATA

VOLUME 1:

Page 68 - Paragraph 1, last line should be deleted.

Page 86 - Insert paragraph 4, which reads as follows:

Sewage Disposal:
Individual septic tanks are the main form of sewage disposal both in Tapleytown and the Gilman Garden Subdivision. The clay till area (Unit 5) has poor to fair permeability and percolative capacity. However, prior to tile field construction, the area should be evaluated for groundwater conditions. The recommended minimum depth to groundwater for a clay till is 12 feet. In the Gilman Garden Subdivision, this separation may not always exist and it is possible that septic tank effluent is interfering with the quality of the aquifer.

Generally, the shallowness of the granular till suggests that this area should not be considered for further development on the basis of septic tank systems for sewage disposal.

Page 98 - Paragraph 2, line 4, "1.0 acres" should read "2.0 acres".

VOLUME 2:

Plan No. 8 - "Flamboro Centre" should be "Flamborough Centre".

Plan No. 14 - "Mountsburg" should be "Mountsberg".

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PLANNING AND DEVELOPMENT DEPARTMENT

OFFICIAL PLAN DIVISION

"SETTLEMENT CAPABILITY STUDY"
FOR
THE HAMILTON-WENTWORTH REGION

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VOLUME 2

- REGIONAL AND SETTLEMENT REPORTS

Plan No.:	Title:
1	Generalized Groundwater Probability (Regional)
2	Generalized Groundwater Quality (Regional)
3	Generalized Septic Disposal Suitability (Regional)
4	Alberton - (Town of Ancaster)
5	Carluke - " -
6	Copetown - " -
	Jerseyville - " -
7	Southcote - " -
8	Brockview - (Township of Flamborough)
	Flamborough Centre - " -
9	Freelton - " -
10	Greensville - " -
	Harpers Corners - " -
11	Kirkwall - " -
12	Lynden - " -

Plan No.:	Title:
13	Millgrove - (Township of Flamborough)
14	Mountsberg - - " -
15	Orkney - - " -
16	Rockton - - " -
	Sheffield - - " -
17	Strabane - - " -
	Troy - - " -
18	Westover - " -
19	Binbrook - (Township of Glanbrook)
	Dickenson Rd. Area - - " -
20	Mount Hope - - " -
21	Woodburn - - " -
22	Tapleytown - (Town of Stoney Creek)
	Vinemount - - " -
23	Generalized Development Suitability (Regional)

INTRODUCTION

Twenty-six settlement areas in the Regional Municipality of Hamilton Wentworth have been studied to determine the terrain conditions, suitability of the soils for septic tank and tile field systems and aquifer conditions to establish the development capability of the settlement, based on the provision of water and sewage services.

Also, three additional areas have been defined which offer a potential for rural development in the Region based on the provision of private individual wells and septic tank and tile field systems. The Region, as a whole, has been studied to identify the general groundwater conditions, and suitability of areas for the installation of tile fields.

The study has been completed utilizing information available on the Region and the individual settlements, together with the analysis of stereo photography for the settlement for the settlement.

This report is an outline of the findings for each settlement and has been prepared in two volumes. Volume 1, is the written text and includes: a Summary and Recommendations of the Growth Potential for the Settlement Summary of the Findings of the Individual Settlement, a Regional Assessment and a report on each settlement. Also, included in the appendices is a discussion on Water and Sewage Systems, a Glossary of Terms, a description of the soil types, an outline of the Servicing Options for Binbrook and a discussion of Communal Water Supplies. Volume 2 includes the plans for each settlement which show, the soil type, land slopes, water courses, areas of very high water table and areas not considered suitable for development. The plans should be examined with the written text in order to obtain a correct interpretation. Also, there may be small areas within a particular soil type, shown on the plan which differs and consequently, all proposed development should be supported with tests conducted at each site to ensure an adequate soil type, water table location and well for the intended use.

ACKNOWLEDGEMENTS

The willing and helpful supply of information by the staffs of the Region's department is greatly appreciated. Also, the information provided by the Halton Region Conservation Authority, Hamilton Region Conservation Authority, The Niagara Conservation Authority and the Ministry of the Environment was most valuable in carrying out this project.

While many have been involved, all of whom provided a significant contribution, the assistance offered by Mr. R. Bailey, Mr. H. Weinberg Mr. M. Afsar and Dr. R.F. Colgate is appreciated.

SUMMARY AND RECOMMENDATIONS

SUMMARY AND RECOMMENDATIONS

A. Growth Potential of Settlements

Based on the provision of individual private septic disposal and water supply systems, and existing terrain conditions, Table I indicates the possible extent of settlement growth. It must, however, be noted that the growth potential listed has not included a consideration of possible environmental impact, the need to preserve farm land or consideration of additional community needs such as schools, recreation facilities, etc. Table 1 indicates only the potential with regard to septic disposal, water supply and existing terrain conditions.

TABLE 1

Settlement	Present Population (approximate)	Maximum Community Size (approximate)
Town of Ancaster		
Alberton	50	350 - 500
Carluke	50	200
Copetown	250	300 - 400
Jerseyville	250	500
Southcote	50	400
Township of Flamborough		
Brockview	100	100 - 200
Flamborough Centre	200	500 - 700
Freelton	250	750
Harpers Corner	100	300 - 400
Kirkwall	50	200
Lynden	640	700 - 800
Millgrove	600	600
Mountsburg	100	200 - 300
Orkney	50	200 - 300
Rockton	100	100 - 150
Sheffield	100	200
Strabane	100	300 - 500
Troy	50	100
Westover	50	200

Settlement	Present Population (approximate)	Maximum Community Size (approximate)
Township of Glanbrook		
Dickenson Rd.	250	250 - 300
Woodburn	200	200 - 300
Town of Stoney Creek		
Tapleytown	100	100 - 200
Vinemount	100	200

STUDY AREAS

1. (Township of Flamborough)*
2. (Town of Ancaster)*
3. (Township of Glanbrook)*

(*see individual statements on Area growth potential.)

It must be noted that the settlements of Jerseyville and Lynden presently exhibit public health problems, which should be rectified prior to considering the additional growth indicated in Table 1.

In addition to the above-noted settlements and study areas, several other communities have either reached their growth potential on individual systems or exhibit public health problems which require attention prior to additional growth. The installation of Municipal Services (sanitary sewage and water supply) in these communities would permit additional growth with the development limit to be established by the Regional Municipality of Hamilton-Wentworth, based on the availability of sewage treatment and water supply capacities. These settlements are:

Community	Present Population (approximate)
Township of Flamborough	
Greensville	2000
Township of Glanbrook	
Binbrook	350
Mount Hope	900

B. Summary of Findings of Individual Settlements

The following information is intended to provide only a capsule summary of the individual settlement findings. The full statement on each settlement should be reviewed in conjunction with the area plans.

TOWN OF ANCASTER

Alberton:

(Plan 4) The soils are generally well drained clays, silts and fine sands, with the water table located within 8 feet of ground surface.

Existing wells utilize perched granular and bedrock aquifers for water supply.

An apparent high water table, in conjunction with some soil types, limits the available lands for development.

Carluke:

(Plan 5) The soils are lacustrine silty clay with no apparent organic features or high water table areas.

Existing wells utilize granular and bedrock aquifers for water supply and the water quality is generally poor.

Low density development appears possible, depending upon acceptance of water quality, both of which limit the development capability of the area.

Copetown:

(Plan 6) The soils are mainly sands and gravels and the area has a rolling topography.

Existing wells utilize granular overburden and bedrock aquifers for water supply.

Future growth appears possible in areas where adequate separation between ground surface and the overburden aquifer exists, although the bedrock aquifer capacity limits development potential.

Jerseyville:

(Plan 6) The soils are transitional and range between lacustrine silty clay and silty sands.

Some existing wells utilize an overburden aquifer, located within 15 feet of ground surface, for water supply, but most wells are developed in the bedrock aquifer.

Further development appears to be restricted by the bedrock aquifer capacity, although there is potential for limited growth on adequately sized lots.

Southcote:

(Plan 7) The soils are generally well drained lacustrine sands, silts and clays with some organic deposits.

The existing granular overburden aquifer, located within 15 feet of ground surface and the bedrock aquifer are used for water supply.

Further development appears restricted by the aquifer capacity, but growth on adequately sized lots in areas of low water table appears possible.

TOWNSHIP OF FLAMBOROUGH

Brockview:

(Plan 8) The soils are fine sands and granular tills with several organic deposits.

A bedrock aquifer is generally the source for the existing private wells.

A high water table condition in the fine granular soils and low bedrock aquifer potential limits further development.

Flamborough Centre:

(Plan 8) The soils are well drained, fine lacustrine silty sands with the exception of the organic deposits and high water table areas.

A bedrock aquifer is generally the source for existing private wells.

Further development on adequately sized lots appears possible.

Freelton:

(Plan 9) The soils are generally well drained granular tills with the exception of some organic deposits.

A bedrock aquifer is generally the source for existing private wells, although there may be high levels of nitrate in the water.

Continued development in areas of adequate separation between ground surface and water table appears possible.

Greensville:

(Plan 10) The extent of the community and existing well pollution

problems indicate the need for municipal water supply and sewage disposal. Until such facilities are provided, only minor growth should be permitted.

Harpers Corners:

(Plan 10) The soils are a combination of granular tills, sands and gravels, and organic deposits.

A bedrock aquifer is generally the source for private wells, although a shallow granular aquifer is used in some instances.

A high water table condition in the granular soils limits the potential for development to areas of adequate separation between the water table and the ground surface.

Kirkwall:

(Plan 11) The soils are generally shallow granular tills with a large organic area located northeast of the settlement.

A bedrock aquifer appears to be the major source for existing private wells.

Shallow overburden depth to bedrock limits the development potential on individual water supply and sewage disposal systems. The installation of a communal well, isolated from the developed area water supply, could provide for limited growth.

Lynden:

(Plan 12) The soils are generally silty sands with minor contents of silty clay or clayey silt. The developed area of the community is poorly drained, while the surrounding area is generally well drained.

Bedrock and granular overburden aquifers are used for existing water supplies, although the water quality is poor.

Existing public health problems within the community and estimated aquifer potential limit growth potential.

Millgrove:

(Plan 13) The soils are predominantely lacustrine silty sands with areas of clay tills.

Bedrock and granular overburden aquifers are used for existing water supplies, although the majority of existing wells exhibit adverse bacteriological counts.

The extent of the existing community, limited groundwater potential and existing water quality problems limit the growth potential.

Mountsberg:

(Plan 14) The soils are a combination of granular tills, sand and gravels, with several organic deposits. Surface drainage is generally imperfect, with some poorly drained organic deposits.

The bedrock located, in some instances at ground surface, is generally the source for existing water supplies.

Further development in areas of adequate overburden to bedrock and/or groundwater table appears possible.

Orkney:

(Plan 15) The soils are predominantely lacustrine silty sands with silty clays at the bottoms of the water courses.

Granular overburden aquifers are the major sources of water supply in the area, but are of limited extent.

The condition of groundwater availability and soil conditions provides some future development potential.

Rockton:

(Plan 16) The soils are a combination of fine silty sands and shallow granular tills over bedrock.

The bedrock aquifer is generally the source for existing water supplies within the settlement.

Overburden depth to bedrock limits the development potential of the community.

Sheffield:

(Plan 16) The soils are predominantely lacustrine clays with clay tills and shallow granular tills over bedrock deposits.

The bedrock aquifer is the major source for existing water supplies within the settlement, although there is a high mineral content in the water.

Requirements for overburden depth, lot sizes and water quality limit the development potential for the community.

Strabane:

(Plan 17) The soils are a combination of granular tills, sand and gravels, and organic deposits.

The bedrock aquifer is the principal source of water supply.

Further development in areas of adequate overburden and separation from water table with adequately sized lots appears possible.

Troy:

(Plan 17) The soils are predominantely silty sands with clays at the bottom of the watercourses.

The bedrock aquifer is the principal source of water supply for the community, although it has a high sulfate concentration.

A shallow overburden, combined with a generally unacceptable water quality, limits the development potential of the community.

Westover:

(Plan 18) The soils are a complex variety of clay tills, granular tills, and organic deposits.

A bedrock aquifer, located between 2 feet and 50 feet from ground surface, is the principal source for water supply in the settlement.

Further growth in areas of sufficient overburden depth with adequately sized lots appears possible.

TOWNSHIP OF GLANBROOK

Binbrook:

(Plan 19) The extent of the community, existing well pollution problems and apparent lack of adequate groundwater supply indicate the need for municipal water supply and sewage disposal facilities. Until such facilities are provided, only minor growth should be permitted.

Dickenson Rd. Area:

(Plan 19) The soils are predominantely lacustrine silty clay and are generally well drained.

Bedrock and granular overburden aquifers are the sources of water supply for the community.

Limited development appears possible on adequately sized lots in areas of sufficient overburden depth to water table.

Mount Hope:

(Plan 20) The extent of the existing development and groundwater shortages due to low potential groundwater yields limit future growth on individual water supply and sewage disposal systems. The Region's Hamilton Water and Sewage services should be extended to serve the present development prior to considering any further growth.

Woodburn:

(Plan 21) The soils are a combination of lacustrine silty clays and clay tills, and are generally well drained.

A bedrock aquifer is the principal water supply source, although the water has a high iron and sulfate content.

The present extent of the community, combined with the poor water quality and low aquifer potential, limits further development within the community.

TOWN OF STONEY CREEK

Tapleytown:

(Plan 22) The soils are generally a clay till overlying bedrock.

Shallow bedrock wells are the major source of water supply in the area, although water quality is poor owing to a high sulfate content.

The limited groundwater potential, combined with poor water quality, limit the development potential of the community.

Vinemount:

(Plan 22) The soils are mainly clay tills overlying bedrock.

A bedrock aquifer is the principal source of water supply for the community, although the water has a generally high sulfate content.

Poor water quality, low estimated aquifer yields and thin overburden limit the development potential of the community.

Study Area 1:

(Plan 23) The soils are mainly granular deposits with several organic and shallow till areas.

The bedrock aquifer well yields in the area are estimated at 50 g.p.m. with a possible yield of up to 200 g.p.m. from a multiple well system.

Sufficient overburden depths, combined with the probable aquifer yields, indicates that this area would be suitable for development on adequately sized lots.

Study Area 2:

(Plan 23) The soils are generally lacustrine silty sands with areas of silty clay or clayey silt within the sand plain.

The bedrock aquifer offers the greatest potential yields, estimated to be approximately 100 g.p.m. for a single well.

Sufficient overburden depths, combined with the said probable bedrock aquifer yields, indicates that this area could be suitable for development on adequately sized lots.

Study Area 3:

(Plan 23) The soils are generally clay tills with pockets of lacustrine clay lining portions of the larger stream channels.

The bedrock, located from 70 feet to 90 feet from ground surface, exhibits potential aquifer yields of up to 100 g.p.m., although the water may have noticeable sulfur content.

Sufficient overburden depth, combined with the said probable bedrock aquifer yields, indicates that this area could be suitable for development on adequately sized lots.

REGIONAL ASSESSMENT

REGIONAL ASSESSMENT

An overall assessment of the entire Region has been completed and the findings are shown on the following Plans:

Generalized Groundwater Probability	- Plan 1
Generalized Groundwater Quality	- Plan 2
Gereralized Septic Disposal Suitability	- Plan 3

The information derived from these plans was used in conjunction with surficial geology information to identify three areas within the Region which exhibited the greatest potential for growth based on individual septic disposal and water supply systems. The three areas are shown on Plan 23, titled, Generalized Development Suitability.

It is emphasized that the boundaries established on Plans 1, 2, 3 and 23 are intended to evaluate the general conditions of the Region and that exceptions are likely to exist in all areas. Accordingly, the plans are intended to serve only as a general guide for the purposes of this study, with settlements being investigated on an individual and detailed basis.

Generalized Groundwater Probability (Plan 1)

Groundwater probability considers the quantity of groundwater available from the principal aquifer. This information was derived from a review of well logs of completed wells in the Region, a review of reports completed for specific areas and publications relating to the geological description of the Region.

A private individual supply well must be capable of providing the maximum day demand of the average dwelling unit on a continual basis. The estimated water usage of such a residence is approximately 360 gallons per day. Thus, an aquifer with an estimated capacity of 25 g.p.m. (36000 g.p.d.) would be sufficient to support a maximum of 100 homes.

A communal water system designed to provide the normal demands of a small community with storage facilities for fire protection and peak hour demands must have a pump-tested, long term capability of at least 0.5 g.p.m. (720 g.p.d.) per home. Further, when operated at this rate, the well system should not exceed the long term recharge capability of the aquifer. Consequently, a communal well system with a rated capability of 25 g.p.m. would be sufficient to serve only 50 homes. It is noted that this discussion does not include the requirement for a stand-by well or other facilities that normally would be necessary for a communal well system.

In summary, the use of a communal well system reduces by approximately 50%, the population that could be served by individual well systems on the same aquifer potential. This must be considered when the installation of a communal well is proposed to alleviate water supply problems in an area presently served by individual wells. In such an instance, the aquifer potential must be allocated to the existing development which is experiencing water shortages prior to considering any further growth.

In broad terms, the Region has an adequate supply of groundwater, not considering quality, to support significant growth based on groundwater supplies. The difficulty in obtaining the water lies in the fractured nature of the bedrock. The potential yields from the bedrock aquifer vary with the degree of fracturing of the bedrock as noted in the description of the various Units of Groundwater Yield.

Accordingly, the extent of development in a particular area, should be carefully assessed to assure an adequate potable supply.

Owing to the fractured nature of the bedrock, there appears to be only a 50% probability that a well drilled (on each lot the case of individual private wells) will be successful in obtaining an adequate supply, since it is necessary to encounter a water-bearing fracture. However,

there will generally be a water-bearing fracture located within each lot. For this reason, it is recommended that, in the case of development on individual water supplies, each well be proven to be water producing prior to the issuance of a building permit.

The Units indicating the probability as to quantity, as shown on Plan 1, are as follows:

Unit 1 - This area yields poor domestic and municipal supplies from the bedrock aquifer and is not considered to have a sufficient water supply for the development of individual or communal water systems.

Unit 2 - The principal aquifer is fractured dolomite, which generally exhibits tight fracturing and, subsequently, relatively low yield wells. Indications are that well systems up to 25 gpm can be developed. Although some wells which encounter local high fracture areas may yield up to 100 gpm, the probability for such yields is low. The probability that an individual homeowner will be successful in obtaining an adequate supply with the first attempt is fair to good.

Unit 3 - The principal aquifer is fractured dolomite, which has moderate fracturing and yields up to 50 g.p.m. can be developed. It is suggested that all subdivision development proposals be supported with test well data indicating the existance of an acceptable water supply prior to the issuance of any development approvals. Wide variation can be expected in the well capacities developed in this area as it is the degree of fracturing of the bedrock coupled with the existance of connections to groundwater recharge areas that will determine the pumping capacity of wells in a particular area.

Unit 4 - Moderate to major fracturing in the dolomite principal aquifer can yield up to 100 g.p.m., while some local areas indicate yield potential in excess of 100 g.p.m. This unit is generally in a recharge area, since bedrock is at, or close to, ground surface. The recharge source is precipitation which percolates to the bedrock fractures. Consideration should be given towards the establishment of a higher service level in order to provide a reasonable degree of fire protection, since the aquifer is capable of supporting a significant development. Development in this area should be permitted with stringent controls excercised relative to potential pollution dangers, particularly from septic tank tile field systems.

Unit 5 - The principal aquifer is the granular overburden, which exhibits yields of up to 100 g.p.m. Extensive groundwater supplies have been developed in this area to serve existing development. Therefore, it appears, that further growth should be considered on the basis of providing water from the Hamilton system as the total aquifer potential may now be reached.

Generalized Groundwater Quality (Plan 2)

Groundwater quality is indicated on Plan 2. The hatched area indicates poor water quality resulting from hydrogen sulfide (in some areas, so high as to discolour water), sulfates and in some instances chlorides. These conditions may be treatable; however, economics would be of prime consideration and alternative water supplies should be investigated.

Water quality in areas other than those which have an indicated imperfect quality are generally suitable for human consumption.

It must be noted that, with a bedrock aquifer supply, the quality of water obtained varies considerably and that the areas have been shown on Plan 2 to indicate only the general trend of water quality. Each supply source should be tested for potability, as recommended in the Ministry of the Environment publication "Guidelines and Criteria for Water Quality Management in Ontario".

Generalized Septic Disposal Suitability (Plan 3)

The criteria used to determine areas suitable for the disposal of septic tank effluent are as follows:

A) Fine grained soils (i.e. clay) were considered poor due to very low permeability and percolative capacity. Coarse grained soils (i. e. tills and sand) were considered fair to good.

B) Depth to groundwater was considered. The minimum depths for fine and coarse grained soils should be 12 and 20 feet respectively for distance to potable water supply source from ground surface.

A description of the Legend used on Plan 3 is as follows:

1. Areas considered good:

These areas are considered to present opportunities for the establishment of settlements restricted to residential use, small schools and small commercial establishments with an ultimate population of 800 to 1000 persons.

Unit A - Soil is coarse granular, sandy loam, sand and gravel, having good permeability and percolative capacity and having soil cover to water table in excess of 25 feet. Lot areas of 0.50 acres minimum shall be required for the development of private water supply and sewage disposal system in these areas.

2. Areas considered fair:

These areas are considered to present a reasonable opportunity for the development of small settlements on the basis of limited growth utilizing private wells and septic systems.

Unit B - Soil is a clay till or granular till having a fair percolative capacity. Adequate overburden cover to the principal aquifer exists within this unit. Groundwater is within 25 feet of surface giving the area a marginal consideration. These soils and water table location offer a reasonable opportunity for the development of small settlements on the basis of private wells and septic tank and tile field system.

Minimum lot areas of 0.50 acres for granular tills and 1.25 acres for clay tills are suggested with only small communities (less than approximately 500 people) being located in one area to prevent over saturation of the surface soils and pollution of the water table.

Unit C - Soil is a granular till, clay till, or sand and gravel having fair to good percolative capacity.
Similar conditions apply as in Unit B for the establishment of septic tank tile field systems for sewage disposal except that, communities of only up to 200 should be developed.
Minimum lot areas of 0.50 acres for granular tills, sand and gravel soils and 1.25 acres for clay tills are required.

3. Areas considered poor:

These areas generally should not be developed with rural settlements unless full municipal water and sewage services are provided.

Unit D - Soil is clay having poor to fair percolative capacity or clay till with groundwater within 20' of surface, both of which give the area a marginal consideration. The low percolation capacity of the soil indicates that a minimum lot size of 2 acres should be provided for each residence. Development of these areas on the basis of septic tank and tile field systems is generally not recommended due to the soil characteristics, although it may be considered on an individual proposal basis.

Unit E - Soil is a clay till, granular till, or sand and gravel. Fair to good percolative capacities exist , however, groundwater is generally found within 20' of ground surface. These soils would normally be acceptable for the construction of septic tank and tile fields, except for the danger of pollution of the ground water table. This is particularly

pertinent for development where both individual private wells and septic tank systems are proposed. The provision of a "protected" communal well system (i.e. isolated from the development) may partially solve the problem depending on the capability of the aquifer to support a communal well and the proximity of existing wells in the high water table aquifer. Minimum lot areas of 0.50 acres for sand and gravel soils and 1.25 acres for clay tills are suggested when using individual water and sewage systems.

Unit F - Soil is a clay having low permeability and percolative capacity with water table generally being found within 12 feet of ground surface. The low permeability is demonstrated by a high percolation time (up to 120 minutes), and would require the construction of very large tile fields. The shallow water table condition requires that caution be exercised in allowing development in these areas due to the danger of polluting the water table where individual wells are utilized as a potable water supply. In some locations it may be possible to import a fill material which can be placed over the clay, the latter being left undisturbed. In clay soils, the disturbance of the ground with construction equipment causes a change in the soil structure and a reduction in permeability. Development in these areas should be very low density housing since the land is generally not considered to be suitable for subdivision development. The recommended lot size is 2 acres minimum.

Unit G - Shallow swamp or high bedrock features are indicated as "organic". These areas are poorly drained and have a relatively high water table condition. Accordingly, they are not considered to be suitable for the installation of private septic tank and tile field systems due to the inability of the soils to absorb septic tank effluent. Tile fields constructed in areas with organic soils and water table close to the ground surface do not have the capacity to

to accept further inputs without ponding occurring. In such cases, even with the construction of "raised" tile beds, all sewage that is not removed from the bed through the evapotranspiration process, seeps downward to the bottom of the "fill" and weeps out at the interface of native and fill material resulting in the creation of a public health hazard. All development should be located outside these areas.

It should be noted that the terrain analysis was carried out on the basis of available data and that the areas are generally as indicated. Therefore, it is expected that, the plan will be used only as a general reference document.

SETTLEMENT REPORTS

TOWN OF ANCASTER

ALBERTON

The settlement is located approximately 1 mile west of the junction of Highways 52 and 2, in the Town of Ancaster, in Concessions 2 and 3, Lots 24 and 25. The present population is approximately 50 persons, with the development fronting on Highway 2.

Surficial Geology, Drainage and Topography:

The soils at Alberton are a mixture of clay, silt and fine sand and, although the soils types are defined by a line boundary on the plan, the change in soils types is transitional. The majority of the area is shown as Unit 2 (clays, see Appendix C for definition), but, locally, the soil will vary from a silty clay to a clayey silt with possibly a minor sand content. The soils on the east and west edges of the community are slightly coarser with a grading from fine silty sands to sandy silts. The land is well drained by several intermittent drainage courses which empty into major channels on the east and west borders of the community, all of which are tributary to Big Creek. The ground surface is gently rolling with slopes of less than 10%; however, the banks of the two major streams and several of their tributaries have side slopes of 10% to 20%. Plan No. 4 shows these features.

Water Supply:

The community is serviced by private individual wells. The majority of the wells obtain their supply from a fractured dolomite which is located at depths ranging from 70 feet to 160 feet from ground surface. The other wells obtain their water from granular aquifers within the overburden, which are generally perched in nature and limited in areal extent. The potential of obtaining yields of up to 50 g.p.m. from the fractured dolomite is good, while the potential for higher yields is poor. There is no specific water quality data available; however, generally it appears that the water quality is satisfactory for domestic use.

ALBERTON (Cont'd.)

Sewage Disposal:

The community is serviced by private individual septic tank and tile fields. The clayey silt and silty clay areas (Unit 2) have poor to fair permeability and percolative capacity, while the finer granular soils (Unit 4A) have fair to good permeability and percolative capacity. Existing data indicates that the perched water table conditions may be encountered approximately 8 feet from ground surface. For tile field construction, the minimum depth to the water table should be 12 feet in the clayey silt and silty clay (Unit 2) areas and 20 feet in granular soils (Unit 4A) areas when overburden wells are utilized as the source of water supply.

Growth Limitations:

The existing soils conditions within the community generally do not pose restrictions on the development potential of the community, other than the required size of lot. Groundwater availability appears to be the restrictive factor with regard to further development.

The recommended lot size for development within Unit 2 soils is a minimum of 2 acres to accommodate the poor to fair percolative capacity of the soils. Unit 4A, however, is not recommended for significant development since groundwater is generally found close to the ground surface. This condition should be verified with on-site borings which may permit very limited growth within this soils unit area.

Based on development on 2-acre lots within Unit 2 soils, ground slopes of 0% to 10% and potential aquifer yields of 50 g.p.m. Alberton could grow to a population of approximately 500 persons, within the area shown on Plan 4, on the basis of private individual wells and septic systems being used. The provision of a communal water system would restrict this development to approximately 350 people due to greater demands placed on the system, as compared to individual wells servicing each home. All development should be controlled to restrict the location of any tile fields within 50 feet of the intermittent drainage course.

CARLUKE

Carluke is located approximately 5 miles south of Ancaster on Regional Road 22. It lies in the jurisdiction of the Town of Ancaster, in Concessions 6 and 7, Lots 37 and 38. The population is approximately 50 persons.

Surficial Geology, Drainage and Topography:

Carluke is situated on a plain of lacustrine silty clay (Unit 2). The land is well drained and there are no organic or high water table areas. There are several intermittent streams which drain the area during times of heavy precipitation and snow melt. These water courses, when flowing, appear to contribute to the recharge of the overburden aquifer and are tributary to the Big Creek. There are several areas of 10% to 20% slopes associated with the stream banks, but otherwise the land surface is gently rolling with slopes generally less than 10%. Carluke is shown on Plan No. 5.

Water Supply:

The settlement is served by private individual wells. The majority of the domestic wells obtain their supply from the fractured dolomite located at depths ranging from 60 feet to 86 feet from ground surface. Other wells obtain their water from a granular aquifer with a thickness less than 5 feet overlying the bedrock. The potential for obtaining yields of up to 50 g.p.m. from the fractured dolomite is good, while the potential for higher yields is poor. There is no specific data available concering groundwater quality, but data from surrounding areas indicates that the water contains excessive amounts of dissolved solids, hydrogen sulfites and chlorides and is, therefore, poor in quality.

Sewage Disposal:

Private individual septic tank and tile field systems are utilized. The silty clay has poor to fair permeability and percolative capacity. The

CARLUKE (Cont'd.)

available data does not indicate perched groundwater conditions but all future tile fields constructed should be located with maximum isolation from the well, with information on the water table location obtained at the time of construction of the well. The minimum depth from ground surface to the static water level of a perched overburden groundwater source should be 12 feet for tile field construction.

Growth Limitations:

The poor water quality in the Carluke area would tend to minimize the growth potential of the settlement. Protection of surficial drainage requires that tile field construction be at least 50 feet away from watercourses.

It appears that limited growth on individual wells and septic systems could be permitted, being only restricted by the water quality, a constraint to be determined by the individual home owners. It is further recommended that all future wells be drilled and that lot sizes be a minimum of 2 acres to accommodate the percolative capacities of the Unit 2 soils.

Based on development on 2 acre lots within Unit 2 soils, ground slopes of 0% to 10%, acceptance of water quality and potential aquifer yields of 50 g.p.m., Carluke could grow to a total population of approximately 200 persons with the area shown on Plan 5, utilizing individual private wells and septic disposal systems.

COPETOWN

Copetown is located at the junction of Highways 52 and 99, partially within the Town of Ancaster and the Township of Flamborough, approximately 5 miles west of the built-up area of the Town of Dundas. Its population is approximately 250 persons.

Surficial Geology, Drainage and Topography:

Copetown is situated on a kame moraine, composed mainly of sand and gravel. Most of the soil is a fine silty sand, but there are local concentrations of clay and silt. The Unit 4B soils contain a high concentration of coarse granular material and west of Highway 52 there is a small pocket of shallow organic soil, located outside of the area shown on Plan 6. Drainage is good to imperfect, with small pockets of soils with a high water table which generally correspond to the areas of high clay and silt content. There are a few intermittent drainage features tributary to Big Creek which carry excess surface runoff. The drainage features, as well as soil Units 1 and 4C, appear to be influent (groundwater contributing to feature). There are two areas with moderate terrain slopes of 0% to 10% south of the community, but the rest of the topography is quite rough with surface slopes of 10% to 20%.

Water Supply:

The community is presently served by private individual wells with the majority of these wells obtaining their water supply from granular overburden aquifers. These aquifers are located at depths ranging from 20 feet to 70 feet from ground surface and have a thickness of up to 30 feet. They appear to be interconnected and are relatively large in areal extent. Other wells obtain their water supply from the fractured dolomite located at a depth of approximately 120 feet from ground surface. The potential for well yields of up to 50 g.p.m. from the fractured dolomite is good but, for higher yields, the potential is poor. Available data indicates that the groundwater quality is suitable for domestic purposes.

COPETOWN (Cont'd.)

Sewage Disposal:

The settlement is serviced by private individual septic tank and tile bed systems. The organic soil area (Unit 1) and the wet granular soil area (Unit 4AC) are not suitable for tile fields. The fine granular soils (Unit 4A) and coarse granular soils (Unit 4B) have good to excellent permeability and percolative capacity and are best suited for tile fields. Static water levels in the overburden aquifers range from 10 feet to 50 feet from ground surface and, therefore, prior to tile field installation, testing should be carried out to determine the depth to overburden water table. For tile field installation, the minimum depth to the static water level in both the fine granular soil (Unit 4A) and coarse granular soils (Unit 4B), should be 20 feet. Areas with soil Unit 4B should be carefully examined as the presence of a gravelly soil with a water table at a depth of 20 feet may not be suitable for development, unless all residents in the area are provided with a communal water supply.

Growth Limitations:

The best area for development, relative to tile fields, appears to be Unit 4A, where the potential for groundwater pollution is minimized. Also, it is suggested that the tile fields be constructed at least 200 feet from the edge of drainage features. Units 1 and 4AC are not suitable for development using tile fields, due to their organic content and high water tables, respectively.

Low density development within Unit 4A could be permitted, although a large scale project should not be considered. The settlement, in general, can be classified as "marginal" when considering future development potential and should not exceed an ultimate population of 300 to 400 persons.

COPETOWN (Cont'd.)

This restrictive development program is suggested as a safeguard against oversaturation of the soils with septic tank effluent which could result in contamination of the granular aquifer.

Infilling and minor community expansion should be restricted to lot areas of 0.50 acres minimum for septic tank systems and individual drilled wells. Also, due to the steep gradient to the land, the area set aside for tile fields must be suitable for construction of the tile field.

JERSEYVILLE

Jerseyville is located on Regional Road 3, 6 miles west of Ancaster, in Concession 2, Lots 18 and 19. It has a present population of approximately 250 persons.

Surficial Geology, Drainage and Topography:

Jerseyville is situated in the transition zone between lacustrine silty sand and lacustrine silty, sand clay. As in other cases, although the two soil types are defined by a line boundary on the plan, the change in soil types is gradual. The major drainage channel, just east of the community, carries storm run-off to the south and is tributary to Big Creek. There are a few intermittent streams which drain into this large channel and, in general, the area is fairly well drained. The ground surface is slightly hummocky, but essentially flat, with slopes of less than 10%. Side slopes on the major drainage channel are 10% to 20%. Plan No. 6 shows these features for Jerseyville.

Water Supply:

The community is presently served by private individual wells. The majority of the wells obtain a supply from the fractured limestone bedrock which is located at depths ranging from 45 feet to 130 feet from ground surface. Others obtain water from the granular overburden which ranges in depths from 15 feet to 35 feet from ground surface. Indications are that the static water level of the perched water table is approximately 15 feet from ground surface. The potential for yields of up to 50 g.p.m. from the bedrock aquifer is good, but poor for higher yields. Available data indicates that the groundwater quality is generally acceptable for domestic purposes, although there is a noticeable hydrogen sulfate content.

Sewage Disposal:

The settlement is serviced by private individual septic tank and tile field systems. In a study undertaken in 1975, 9 out of 11 samples of surface

JERSEYVILLE (Cont'd.)

water and storm run-off indicated the presence of domestic sewage. Although the contamination was not excessive, it is believed that septic tile field failures were the cause, due to inadequate tile lengths on small lots. However, with adequate lot areas, the septic tank tile field system should function satisfactorily. The soils to the north of Jerseyville are a fine granular silty sand (Unit 4A) and have a fair to good permeability and percolative capacity. The depth to the perched water table appears to be adequate, based on available data, although the water level may come to within 10 feet of ground surface during periods of high precipitation.

Growth Limitations:

It is recommended that, prior to considering future development, existing problems within the community should be resolved on an individual basis.

It appears that the perched water table contributes to flows in the major drainage channel running north-south on the east limits of development. This influent condition (groundwater discharging to drainage channel) requires that new septic field installations be a minimum distance of 200 feet from its edge. In addition, when installing new tile fields in areas of perched water tables, a minimum distance from ground surface to water table of 12 feet and 20 feet should be maintained in sandy clay (Unit 2) and silty sand soils (Unit 4A), respectively.

Future growth of the community will generally be limited by groundwater availability. The Unit 2 soils within the community are generally not suited for large scale development, although low density development on 2-acre (minimum) lots could occur. Located generally south of the TH&B Railway, the Unit 2 soils could support a total population of approximately 500 persons within the area shown on Plan 6.

JERSEYVILLE (Cont'd.)

However, as noted, existing problems should be solved by encouraging present residents to construct bedrock wells to achieve greater separation between the aquifer and ground surface. Additionally tile fields should be reconstructed where necessary to provide greater tile lengths. The additional growth noted should be considered only after the present problems have been solved.

The Unit 4A soils, north of the TH&B Railway, are subject to high water table conditions and are not suited to new development.

SOUTHCOTE

Southcote is located approximately 2 miles southeast of Ancaster, in Concessions 4 and 5, Lots 4, 6 and 7, in the Town of Ancaster. The present population is less than 50 persons.

Surficial Geology, Drainage and Topography:

The majority of the area is covered by lacustrine sands, silts and clays with lesser amounts of organic soils and outwash sands and gravels. The settlement is located largely on silty clay soil, with clays and silts (Unit 2) to the east and silts and silty sands (Unit 4A) to the west. The organic and coarse sand and gravel areas are located west and northwest of the community. With the exception of the two small organic features, all of the soils are well drained. The drainage features appear to be the influent type (groundwater discharging to feature) and development of septic fields should not be allowed within 200 feet of the feature. The eastern portion of the area is essentially flat but, in the west half, there are several 10%-20% slopes on the banks of the drainage channels. Plan No. 7 shows these features for Southcote.

Water Supply:

The settlement is presently served by private individual wells. The majority of the domestic wells obtain their supply from granular aquifers within the overburden and range in depth from 15 feet to 35 feet from ground surface. Others obtain their supply from the fractured dolomite bedrock located at depths ranging from 70 feet to 100 feet from ground surface. The potential for yields of up to 50 g.p.m. is good from the fractured dolomite, but it is poor for higher yields. Available data indicates the groundwater quality is generally suitable for domestic use.

Sewage Disposal:

The community is served by private individual septic tank and tile field systems. The organic soil area (Unit 1) is unsuitable for septic fields,

SOUTHCOTE (Cont'd.)

while the clay and silt soils (Unit 2 and 3) have poor permeability and percolative capacity. The fine granular soils (Unit 4A) and the coarse granular soils (Unit 4B) have fair to good permeability and percolative capacity. Well log data indicates that the silt and granular areas have static water levels ranging from 8 feet to 30 feet from ground surface and this aquifer is extensively used for domestic purposes. For clay areas (Unit 2), the minimum suggested depth to the overburden static water level is 12 feet. For silts (Unit 3) and fine and coarse granular soils (Units 4A and 4B), the minimum suggested depth to the overburden static water level is 20 feet.

Growth Limitations:

There appears to be an adequate supply of potable groundwater, thus the restrictive factor on any future development will be the suitability of the soils for septic tile construction. The most suitable areas for low density development will depend on the groundwater conditions.
If the groundwater is found to be relatively high (12 feet to 20 feet from the surface), Unit 2 appears the optimum for development. If the groundwater is more than 20 feet from ground surface, Unit 4A would be better. Development should not be encouraged within Unit 4B unless preliminary studies are carried out to ensure that adequate coarse granular soil cover is present so as not to pollute the potable water supply.

Based on development on 2 acre lots with Unit 2 soils, ground slopes of 0% to 10% and potential aquifer yields of 50 g.p.m., Southcote could expand to a total population of approximately 400 persons within the area shown on Plan 7 utilizing individual private wells and septic disposal systems.

Future growth within the Unit 4A soils should only occur if on-site boring indicate adequate separation between groundwater and ground surface. Development within this unit should occur on minimum of 0.50 acre lots.

BROCKVIEW

Brockview is located approximately 6 miles northwest of the Town of Dundas, on Regional Road 4. It is situated in Flamborough Township, in Concessions 5 and 6, Lots 6 and 7, with a present population of less than 100 persons.

Surficial Geology and Topography:

Fine sands (Unit 4A), granular tills (Unit 6) and organic soils (Unit 1) predominate in the Brockview area. The granular till occurring in the west-central portion is topographically higher than the surrounding lacustrine silty sands. Organic soils are found in the northeast and the northwest corners of the community area. Drainage in the till and most of the sands is good but, in the south, the sands are imperfectly drained and subject to a high water table condition. The land surface is gently rolling with no slopes exceeding 10%, as shown on Plan No.8.

Water Supply:

The community is presently served by private individual wells with most obtaining their supply from the fractured dolomite which is located at depths ranging to 15 feet from ground surface. The potential for yields of up to 50 g.p.m. from the fractured dolomite is good but, for higher yields, the potential is poor. Existing information suggests that the ground water quality is suitable for domestic use, although there are some instances of ground water pollution.

Sewage Disposal:

Septic tank and tile field systems are used for sewage disposal in the settlement. The organic soils (Unit 1) and the wet fine granular (Unit 4AC) areas are not suitable for tile fields. The granular tills (Unit 6 & 7) have fair permeability and percolative capacity, whereas the fine granular soils (Unit 4A) have good permeability and percolative rates. The entire area has a relatively shallow overburden (less than 15 feet) and static water levels in some wells is within 10 feet of

BROCKVIEW (Cont'd.)

ground surface. When considering tile field construction, the minimum depth from ground surface to a perched static water level or bedrock (as in this settlement) for coarse grained soils should be 20 feet.

Growth Limitations:

Development in the Brockview area will be limited as a result of the shallow overburden cover in the area. The most suitable area for tile fields appears to be Unit 6 (granular till) due to its slightly lower permeability and percolative capacity and the likelihood of adequate overburden cover. However, it appears that areas of sufficient overburden thickness (in excess of 20 feet) will be difficult to locate. The organic and poorly drained soils (Units 1 and 4AC) are considered as influent features (groundwater contributing to watercourses) and tile fields should not be constructed within 200 feet of the edge of drainage courses.

In general, Brockview should not expand significantly beyond its present population. Infilling and minor expansion on lots of 0.50 acres could be permitted if sufficient overburden is found. Alternately, raised tile fields could be used in some areas of shallow overburden. Each application would, therefore, require testing to establish the overburden thickness to ensure adequate isolation from domestic well supplies. In any event, it is recommended that Brockview not exceed a total population of 200 persons. It is suggested, that a communal water system should not be constructed as this would tend to increase water consumption and possible difficulties with the tile fields in the shallow overburden areas.

TOWNSHIP OF FLAMBOROUGH

FLAMBOROUGH CENTRE

Flamborough Centre is located about 1 1/2 miles northeast of Highway 6, on Regional Road 43, in the Township of Flamborough. The estimated population is approximately 200 persons.

Surficial Geology, Drainage and Topography:

Flamborough Centre is located on a plain of fine lacustrine silty sand (Unit 4A) There is a large area of poorly drained organic soils (Unit 1) and high water table sands (Unit 4AC) in the western area of the community but, aside from this feature, the rest of the land is quite well drained. There are two small surficial drainage channels close to the settlement which carry runoff to the southwest to Grindstone Creek. The topography is gently rolling with no slopes greater than 10%, as shown on Plan No. 8.

Water Supply:

The community is presently served by private individual wells and most of these obtain their supply from the fractured dolomite located at depths ranging from 50 feet to 60 feet from ground surface. Some wells obtain their water supply from a granular aquifer which overlies the bedrock. This aquifer generally ranges from 1 foot to 5 feet in thickness. The potential for yields of up to 100 g.p.m. from the fractured dolomite is good, while for yields of up to 150 g.p.m., the potential is fair. Existing data suggests that the groundwater quality is suitable for domestic purposes.

Sewage Disposal:

The settlement is serviced by private individual septic tank and tile field systems. The low organic areas (Unit 1) and the wet granular areas (Unit 4AC) are not suitable for tile fields. The fine granular soils (Unit 4A) have good permeability and percolative capacities and are the

FLAMBOROUGH CENTRE (Cont'd.)

most suitable for tile fields in Flamborough Centre. The available data indicates that static groundwater levels in the overburden range from 11 feet to 25 feet from ground surface. Prior to septic field construction, the depth to groundwater should be established with the suggested depth to groundwater being 20 feet in fine granular soils (Unit 4A).

Growth Limitations:

There appears to be an adequate supply of groundwater for future growth and development in the fine granular soils (Unit 4A) area is acceptable, provided favourable static groundwater levels exist. The drainage features appear influent (groundwater contributing to feature) and tile field construction should not be allowed within 200 feet of the edge of the feature. This restriction also applies to the wet granular areas (Unit 4AC) and the low organic areas (Unit 1).

Future development within Unit 4A could be permitted, although a large scale project should not be considered. This is based on a concern that oversaturation of the overburden could occur with extensive growth. Infilling and minor community expansion should be restricted to lot areas of 0.50 acres for septic tank systems and individual drilled wells. Based on development on 0.50 acre lots within Unit 4A soils, ground slopes of 0% to 10% and potential aquifer yeilds of 100 g.p.m., Flamborough Centre could expand to a total population of approximately 500 to 700 persons within the area shown on Plan 8, utilizing individual private wells and septic disposal systems.

Caution must be exercised when developing on Unit 4A soils to ensure that adequate separation between ground surface and water table exists. On-site testing in the spring should be conducted to determine the water table location and this may further restrict the ultimate development

FLAMBOROUGH CENTRE (Cont'd.)

potential of the community by reducing the extent of Unit 4A soils suitable for septic tile field installation.

FREELTON

Freelton is located about 10 miles north of the Town of Dundas, on Regional Road 51, in the Township of Flamborough, Concession 9, Lots 6 and 7. The present population is approximately 250 persons.

Surficial Geology, Drainage and Topography:

The majority of the soil in this area is a granular till (Unit 6) however, there are three east-west trending granular outwash features associated with the till. One esker in the south contains sandy material (Unit 4A), while the two eskers north of it contain gravel and cobble size material (Unit 4B). There are two low areas of organic terrain (Unit 1), one just north of the community, with the other further to the south.

Drainage is generally good with the exception of the two organic deposits. There is an intermittent stream draining each organic area, tributary to the Bronte Creek.

The topography is flat to gently sloping in the north and east, but is more undulating in the south and west. Slopes are predominantly less than 10%, with isolated areas of 10% to 20% slope, as shown on Plan No. 9.

Water Supply:

The majority of the community is presently served by private individual wells. Available data indicates that most of these wells obtain their water supply from the fractured dolomite located at depths ranging from 3 feet to 30 feet from ground surface. The potential for yields of up to 100 g.p.m. from the fractured dolomite is good and it appears that the groundwater quality is suitable for domestic purposes. There have been no reports of well pollution in the area; however, investigations have indicated higher than desirable levels of nitrate in some wells, but

FREELTON (Cont'd)

this nitrate content still lies within the permissible level of 10 parts per million. A subdivision to the south of the community is served by a communal water works system and test pump data indicates well yields in excess of 100 g.p.m.

Sewage Disposal:

The community is serviced by private individual septic tank systems and tile fields. The areas of organic terrain and poorly drained lowlands (Unit 1 and Unit 6C) to the north and south of the town are considered to be unsuitable for tile field construction. The fine and coarse grained soil and granular till areas (Units 4A and 4B and 6) have a fair to good permeability and percolative capacities. However, in some of these areas bedrock appears to be within 20 feet of ground surface with static water levels to within 3 feet from ground surface. With the available data, it is difficult to determine if the granular overburden has groundwater conditions which reflect the piezometric head within the fractured bedrock. The groundwater conditions within the overburden should be evaluated prior to considering construction in these areas. The minimum depth to the overburden water table for septic field installation in the granular till, fine grained and course grained soils, should be 20 feet.

If groundwater in the overburden is not a consideration, the minimum depth to bedrock for septic tile field construction is 12 feet from ground surface. Due to the relatively shallow nature of overburden cover, the most suitable area for low density development would be Unit 6.

FREELTON (Cont'd.)

Growth Limitations:

Further development within the community should be confined to those areas which offer reasonable soil condition for the disposal of septic effluents, being specifically the Unit 6 soils areas. Development within this unit should be confined to areas where the depth of overburden water table is at least 20 feet, unless a communal well system is utilized. A minimum depth of 10 feet to the water table would be acceptable should a communal water system be constructed to serve the existing and any future development.

Construction of tile fields should not be allowed within 200 feet of areas of poorly drained granular till soils (Unit 6C) and organic soils (Unit 1). The drainage feature northeast of the community appears to be an effluent type (feature contributing to groundwater) and development of septic fields should not be allowed within 50 feet of the feature.

The recommended lot size for future development with Unit 6 is a minimum 1.25 acres to accommodate the percolative capacities of the soils. Should significant development within Freelton be desired, the development of a communal well is recommended since very little of the area has adequate separation between ground surface water table.

Based on development within Unit 6, existing ground slopes and a communal well with a confirmed capacity of at least 100 g.p.m., Freelton could grow to a population of approximately 750 persons or approximately 500 persons beyond the existing population.

GREENSVILLE

Greensville is located on Regional Road 4, just north of the Town of Dundas, approximately 1 mile from the municipal boundary, in the Township of Flamborough, Concession 2, Lots 8 and 9. The present population is approximately 2000 persons.

Surficial Geology, Drainage and Topography:

Both outwash sands and gravels (Unit 4A) and clay tills (Unit 5) are found in this area, but the granular soils predominate in the north half of the community. The land is well drained by Spencer Creek and two tributory streams. The northern part of the area is gently rolling with slopes of 0%-10% but, to the south, ground slopes increase to 10%-20%, with some portions of the stream banks sloping at greater than 20%, as shown on Plan No.10.

West of the area shown on Plan No. 10 there is an additional area within the community of Greensville which has not been shown as it is very similar to the area shown with respect to geology, drainage and topography.

Water Supply:

The majority of the community is presently served by private individual wells. Most of the existing wells obtain their water supply from fractured dolomite which is located 10 feet to 90 feet from ground surface, but some wells obtain their domestic supply from granular aquifers within the overburden. The potential for yields of up to 50 g.p.m. from the fracture dolomite is good but, for higher yields, the potential is poor. Available data indicates that the groundwater quality is sufficient for domestic purposes. The existing development, for the most part, is served by individual wells with varying capacities, drawing supply from several overburden and bedrock aquifers. Previous investigations have revealed significant groundwater contamination.

GREENSVILLE (Cont'd.)

The recently developed, Village Green Subdivision, north of Harvest Road utilizes a communal well for water supply. Two wells were developed to supply the water needs of the subdivision and have safe yields of 10 g.p.m. and 30 g.p.m., respectively.

Sewage Disposal:

The community is presently served by private individual septic tank systems and tile fields.The outwash sand and gravel soils (Units 4A and 4B) have good to excellent permeability and percolative capacity. The available data indicates the presence of a water table condition within the sand and gravel soils and static water levels range from 20 feet-30 feet from ground surface. The data also indicates that the water level within the soil results from the hydrostatic head within the fractured dolomite aquifer.

Tile fields constructed in granular soils (Units 4A and 4B) should maintain a minimum distance of 20 feet from ground surface to groundwater or bedrock.

Previous investigations of groundwater quality in the Greensville area have indicated significant well contamination which may, in part, be due to septic tile field failures or inadequate separation from groundwater sources.

Growth Limitations:

This area appears to be capable of supporting very limited growth based on individual water supply and sewage disposal systems. Soil Unit 5 (clay till) appears more favourable than soil Unit 4A (fine granular soil) and the least favourable soil due to the high bedrock and

GREENSVILLE (Cont'd.)

water table conditions, is soil Unit 4B (coarse granular soil). In areas where the natural grade is in excess of 5%, a serial distribution septic field should be considered. Indications are that the surficial drainage features are influent (groundwater drains to feature) and tile field construction should not be allowed within 200 feet of the edge of the feature.

Greensville has, at present, attained and exceeded the maximum desirable population for a community with the Unit 4A and Unit 5 soils types, as reflected in groundwater contamination. Any growth beyond the existing development should be carried out on full municipal services constructed to connect to the Dundas systems for both water supply and sanitary sewerage.

HARPERS CORNERS

Harpers Corner is located approximately 6 miles north of Dundas, on Highway 6, in the Township of Flamborough, Concession 7, Lot 13. The present population is approximately 100 persons.

Surficial Geology, Drainage and Topography:

The soils in this area are a combination of granular tills (Unit 6), outwash sands (Unit 4A) and gravels (Unit 4B) with some small organic areas (Unit 1). Some soils adjacent to the drainage courses are subject to high water table conditions. The soils are generally well drained with the exception of the high water table areas and the organic areas. The natural drainage courses are generally poorly defined, although some have been improved and all are tributary to the Spencer Creek. The land surface is flat to gently sloping with the majority of the slopes being less than 10%.However, there are two areas of 10%-20% slope east of Highway 6. These features are shown on Plan No. 10.

Water Supply:

The community is presently served by private individual wells. The majority of the domestic wells obtain their supply from fractured dolomite located at depths ranging from 10 feet to 20 feet from ground surface. Others obtain their water supply from the granular overburden overlying the bedrock. Static water levels in the granular overburden (within 10 feet of ground surface) are indicative of the hydrostatic head within the fractured dolomite. The potential for yields of up to 100 g.p.m. from the fracture dolomite is good while, for higher yields, it is poor. Available data indicates the groundwater quality is suitable for domestic use.

Sewage Disposal:

The community presently uses septic tank and tile field systems for sewage disposal. The low lying organic and high water table areas within the

HARPERS CORNERS (Cont'd.)

community, indicated as Unit 1 and Unit 4AC, are not suitable for tile field construction. The remaining granular till (Unit 6) and outwash sand and gravel areas (Units 4A and 4B) have fair to good permeability and percolative capacity. However, should field tests confirm the static water level in the overburden material is within 20 feet of ground surface, these areas would not be considered suitable for septic fields with individual private wells on each lot. Available data indicates that the static water level in the granular overburden ranges from 3 feet to 15 feet from ground surface. The most suitable areas for low density development consideration are the granular tills (Unit 6) because their percolative capacity is slightly lower than the outwash sand and gravel areas, thereby reducing the potential of groundwater pollution.

Growth Limitations:

The existing groundwater supply conditions could support growth in the area, providing satisfactory soil conditions for tile field construction can be located. All of the surficial drainage features in the area appear to be the effluent type (drainage feature contributing to groundwater). The minimum allowable distance from these drainage features to the edge of a septic field should be 50 feet. The low lying organic and high water table areas (Unit 1 and Unit 4AC) are considered to be influent type drainage features (groundwater contributing to drainage feature), and a minimum distance of 200 feet from these areas to the edge of a septic field is suggested.

The area with the greatest potential for future low density development is the Unit 6 soils, east and west of Highway 6, north of the 8th Concession Road. Due to the presence of a high water table and the potential of groundwater pollution, it is recommended that, if development is desired within the area, it proceed on the basis of a communal well and water supply system and individual septic disposal systems. The recommended minimum lot sizes for Unit 6 soils is 1.25 acres while for Unit 4 soils it is 0.50 acres.

HARPERS CORNERS (Cont'd.)

Based on a communal well system, individual septic disposal system and ground slopes, Harpers Corners could expand to an ultimate population between 300 and 400 persons within the area shown on Plan 10.

KIRKWALL

Kirkwall is located approximately 1 mile south of Highway 97 on Highway 52, in the Township of Flamborough, in Concession 7, Lot 19. The present population is approximately 50 persons.

Surficial Geology, Drainage and Topography:

The major soil type in the Kirkwall area is a granular till (Unit 6) and most of the till appears quite shallow, particularly in the soil Unit 7 areas, although the two drumlins have a thicker overburden cover. There is some lacustrine silty sand (Unit 4A) southwest of the community centre and an area of organic soil (Unit 1) in the northeast. There are two small streams in the area one north and one south of the community, which provide good drainage to most of the area, although the lower lying sands and shallow tills are imperfectly drained. These water courses are tributary to the Fairchild Creek. All slopes on the drumlin east of the settlement are 10% to 20%, while the drumlin running through the centre of the settlement has only one side slope greater than 10%. The rest of the land surface is gently rolling with slopes of 0% to 10%. These features are shown on Plan No. 11.

Water Supply:

Private individual wells are used to supply water to the community at the present. There is no groundwater data available for this area, however, the indications are that the overburden is fairly shallow and in all probability the existing domestic wells obtain their water supply from the fractured dolomite. Data from the surrounding communities indicate that the fractured dolomite aquifer in this area should have a good potential of yielding up to 100 g.p.m. There is no specific information available concerning the quality of groundwater but indications from surrounding areas imply that the quality should be sufficient for domestic purposes.

KIRKWALL (Cont'd.)

Sewage Disposal:

The community is served by septic tanks and tile field systems. The organic soils (Unit 1) are not suitable for septic fields, but the granular till areas (Units 6 & 7) and the fine granular soil (Unit 4A) have fair and good permeability and percolative capacity, respectively. The groundwater conditions within the top 20 feet of the overburden are not known due to a lack of data and testing should be carried out prior to tile field installation to determine these characteristics. When considering the installation of tile fields in the granular till and the fine granular soils (Units 6, & 4A), the minimum separation from surface to the water table should be 20 feet.

Growth Limitations:

There appears to be an adequate groundwater supply for future growth based on individual wells; however, difficulty may be experienced in locating a favourable area for the construction of tile fields.

The topographically higher areas within Unit 6, generally east of Highway #52, have the best potential of satisfying the overburden thickness and water table requirements for tile field construction. In there areas, where the natural grade is in excess of 5%, a serial distribution tile field system should be considered. The drainage features appear influent (groundwater contributes to feature) and tile field construction should not be allowed within 200 feet of the edge of the feature.

Substantial growth beyond the existing community limits does not appear favourable, although infilling and minor community extensions could be permitted. Detailed investigation with regard to overburden depth and separation from ground surface to water table should be conducted prior to

KIRKWALL (Cont'd.)

considering substantial growth within the community but, based on existing information, the recommended upper limit of development for Kirkwall is 200 persons. The recommended minimum lot sizes within the Unit 6 soils is 1.25 acres.

LYNDEN

Lynden is located 11 miles west of Dundas on Regional Road 3, just north of Highway 99. It lies in the Township of Flamborough, Concession, Lots 12 and 13 and in the Town of Ancaster, Concesssion 1, Lots 12 and 13. The population of the community is approximately 640 persons.

Surficial Geology, Drainage and Topography:

Lynden is located on a plain of lacustrine silty sand (Unit 4A) with pockets of silty clay (Unit 2) or clayey silt (Unit 3) found within the sand plain. The soils are, generally, well drained by several well defined, but intermittent, flowing streams and many small tributaries which ultimately drain to the Fairchild Creek. Within the existing community, surface drainage systems have not been constructed as required and the roads act as barriers to proper drainage. The area is gently rolling, most slopes being 0% to 10%, although the banks of the major channels have 10% to 20% slopes. This information is shown on Plan No. 12.

Water Supply:

The community is presently served by private individual wells with the majority obtaining their supply from the fractured dolomite, located from 140 feet to 170 feet from ground surface. Some wells obtain their supply from granular aquifers within the overburden which may be encountered at depths ranging from 10 feet to 40 feet from ground surface. The overburden aquifers are generally of limited areal extent and appear to be a perched groundwater table. The probability of obtaining yields of up to 100 gpm from the bedrock aquifer is good, although available data indicates that the groundwater quality is generally not suitable for domestic purposes.

LYNDEN (Cont'd.)

Sewage Disposal:

The community is presently having problems with inadequate and malfunctioning sewage disposal systems. There have been problems of leachate ponding above septic tile fields, which is generally attributable to inadequately sized tile fields. In a survey conducted by the Health Unit, samples of surface water at nine of eleven sampling points, indicated the presence of significant levels of bacterial contamination. The silty sand soils (Unit 4A) have fair to good permeability and percolative capacity while the pockets of silty clay or clayey silt which may be found in the area would have poor to fair permeability and percolative capacity. Existing data indicates that a perched water table condition exists.

Growth Limitations:

Existing wells within the community have not exhibited the estimated potential yields which could be a result of improper development.

With regard to sewage disposal, it is recommended that the individual failures presently occurring within Lynden be corrected on an individual basis prior to considering any future development.

Future growth of the community should occur within Unit 4A soils, the dominant unit in the area. It is recommended that lot sizes of 0.50 acres minimum be used to avoid saturation of the native soils

With a communal well supply with a proven capacity of 100 gpm, individual septic disposal systems on 0.50 acre lots and due regard to ground slopes, Lynden could expand to an ultimate population of between 700 and 800 persons within the area shown on Plan 12.

LYNDEN (Cont'd.)

This recommendation is predicated on the assumption that the existing problems in the community have first been rectified and that a communal water supply is provided to service the existing development. The surficial drainage features appear to be effluent and septic tile fields should not be constructed within 50 feet of the edge of the feature.

MILLGROVE

Millgrove is located approximately 2.5 miles north of the junction of Regional Roads 5 and 21, on Highway 6, in the Township of Flamborough, in Concession 5, Lot 19. The present population is approximately 600 persons.

Surficial Geology, Drainage and Topography:

The soils around Millgrove consist mainly of lacustrine silty sands (Unit 4A), with two large areas of clay till (Unit 5) wouth and west of the community centre and one organic deposit (Unit 1) west of Highway 6 and north of Regional Road 21. There is a high water table condition in some of the sands (Unit 4AC) adjacent to the drainage course but, apart from these areas and the one organic feature, the rest of the land is quite well drained by a tributary to Grindstone Creek. The ground surface is flat to gently rolling with no slopes greater than 10%, as shown on Plan No. 13.

Water Supply:

The community is served by private individual wells. The majority of the domestic wells obtain their water supply from fractured dolomite located at depths ranging from 25 feet to 120 feet from ground surface. Other wells obtain their water supply from granular overburden aquifers located at depths ranging from 25 feet to 110 feet from ground surface. The granular aquifer thickness is generally 5 feet to 10 feet. The well supplies in the Millgrove area have been adequate for domestic needs; however, attempts to obtain high capacity wells have not been successful. The bedrock aquifer conditions indicate that there is good potential for yields up to 50 g.p.m., while for yields up to 100 g.p.m.,the potential is fair. Available data indicates that the groundwater chemical quality is suitable for domestic use, although a 1969 study conducted by the Ministry of the Environment indicated that 80% of the samples collected from private wells exhibited adverse bacteriological counts.

MILLGROVE (Cont'd.)

Sewage Disposal:

The community is presently served by private individual septic tank systems and tile fields; however, an existing slaughter house in the area utilizes a holding tank with spray irrigation of the effluent. There have been no reports of septic tile field failures,but the high bacteriological counts in the private wells generally indicates insufficient separation between ground surface and water table or inadequate seals at the well casing tops. The organic soils (Unit 1) and the wet granular soil (Unit 4AC) areas are not suitable for tile fields. The clay tills (Unit 5) have poor to fair permeability and percolative capacity,and the fine granular soils (Unit 4A) have fair to good permeability and percolative capacity. The static water levels and the overburden aquifers range from 8 feet to 45 feet and there are no indications of a perched water condition within the top 10 feet of soil, other than in the vicinity of the drainage courses. When considering the construction of a tile field, the suggested minimum depth to the water table in clay till (Unit 5) is 12 feet and in fine granular soils (Unit 4A) is 20 feet.

Growth Limitations:

Future growth within Millgrove is not recommended until the existing water supply problems are rectified. The community would best be served by a communal well adequately separated from development to minimize possible contamination of the bedrock aquifer at the well location as a result of the existing contaminated groundwater sources. It would be necessary to develop a safe yield of 100 g.p.m. from a multiple well installation to serve the present settlement. The aquifer in this area may not support expansion beyond the existing development. While such a well system (i.e. 2 communal wells) plus standby, with stringent limitations to expansion, represents a significatn liability to the operating authority, any further development in Millgrove should only be considered on the

MILLGROVE (Cont'd)

basis of a communal water system being constructed, first to rectify present problems and, secondly, to accommodate additional development.

The most suitable area for septic tile field construction is the Unit 5 soils. The extent of this soil unit is limited as shown on Plan No. 13, but could be used for development with 1.5 acre minimum lots.
The most prominent soils within the area surrounding Millgrove are the Unit 4A soils, which require lot sizes of (0.5 acres minimum) and a minimum separation of 20 feet from ground surface to water table.

It must also be noted that, should a communal well system be installed, increased water usage may result in failure of existing tile fields which are, at present, operating satisfactorily. This would result from increased water usage by residents when the individual home owner is no longer responsible for the maintenance of his own well. The water courses in the area do not have a significant assimilative capacity and, should a communal sewerage system be installed, a connection to the Dundas system would appear to be necessary.

Based on the extent of the existing community and the size of lots within the developed area, it is recommended that Millgrove be protected from any significant growth.

MOUNTSBERG

Mountsberg is located at the intersection of Mountsberg Road and Regional Road 8, Concession 7, Lot 7, in the Township of Flamborough. The present population is less than 100 persons.

Surficial Geology, Drainage and Topography:

Mountsberg is situated in an area of granular till (Unit 6) with outwash gravels (Unit 4B) south of the community and is dominated by two southeast to northwest drumlins. Between the drumlins, there are areas of shallow granular till (Unit 7) and organic material (Unit 1) over bedrock. The area is generally imperfectly drained with some poorly drained areas adjacent to the watercourse which is tributary to the Bronte Creek. South of Mountsberg Road there is an area of organic soils. The topography is flat to gently rolling, except for the sides of the drumlins, with slopes generally, less than 10%. The sides of the drumlins range from 10% to 20% slope and occasionally exceed 20%. This information on Mountsberg is shown on Plan No. 14.

Water Supply:

The settlement is presently served by private individual wells. Available data indicates that all domestic wells obtain their water supply from the fractured dolomite located at depths varying from ground surface to 90 feet. The potential for yields up to 100 g.p.m. from the fracture dolomite is good; however, the potential for higher yields is poor. Present information indicates that the groundwater quality is suitable for domestic purposes.

Sewage Disposal:

The settlement is presently served by private septic tank and tile field systems. The poorly drained organic and granular areas (Units 1 and 7C) are not suitable for tile fields. These areas are considered influent drainage

MOUNTSBERG (Cont'd)

features (groundwater discharging to drainage feature) and the minimum distance from the edge of a tile field to the feature should be 200 feet. The remaining granular till and coarse granular areas (Units 4B and 6, respectively) have fair to good permeability and percolative capacities; however, bedrock in some of the areas is within 20 feet of ground surface. The depth to groundwater table should be determined in advance of considering the suitability of a proposed development. The minimum depth to static water level within the granular till and coarse granular overburden for construction of septic fields is 20 feet. Further, the construction of tile fields should not be allowed in the coarse granular soils (Unit 4B) if bedrock is within 20 feet of ground surface.

Growth Limitations:

Future development of Mountsberg will generally be limited by soils conditions and existing ground slopes within the study area.

Units 1 and 7C are not suitable for septic disposal systems. Ground slopes further reduce the area which is suitable for future residential development.

The most suitable areas for development are the Unit 6 soils. The recommended minimum lot size within this soil type is 1.25 acres. The coarse granular soils (Unit 4B) are also suitable for development on 0.5 acre lots, but a minimum separation of 20 feet should be maintained between surface and bedrock and/or perched water table.

Based on individual wells and septic disposal systems, Mountsberg could expand to a community of approximately 200 to 300 persons in either Unit 4B or Unit 6 soils, provided adequate consideration is given to the protection of the perched water table.

ORKNEY

The community of Orkney is situated on Regional Road 39, 1 1/2 miles west of the junction of Highway 52, in the Township of Flamborough, in Concession 2, Lots 24 and 25. The population is less than 50 persons.

Surficial Geology, Drainage and Topography:
Orkney is situated on a plain of fine lacustrine silty sand (Unit 4A) with silty clays (Unit 3) at the bottom of some of the drainage features, and one area of organic material (Unit 1). The sands are generally well drained, but the clays may develop a temporary high water table condition during times of heavy precipitation. The topography is gently rolling with slopes less than 10%, as shown on Plan No. 15.

Water Supply:
The community is presently served by private individual wells. The majority of these wells obtain their water from the granular overburden aquifers located within 30 feet of ground surface. The remainder obtain their water from the fractured dolomite located at depths ranging from 60 feet to 220 feet from ground surface. The potential for yields of up to 50 g.p.m. from the fractured dolomite is good but, for higher yields, the potential is poor. Available data indicates that the ground water quality is suitable for domestic purposes.

Sewage Disposal:
Orkney is served by private individual septic tank and tile field systems. The organic soil area (Unit 1) is unsuitable for septic fields and the silty soils (Unit 3) and the fine granular soils (Unit 4A) have poor to fair and good permeability and percolative capacity, respectively. The static water levels of the overburden aquifer range from 4 feet to 30 feet from ground surface. For tile field installation, the minimum recommended depth to the water table in fine granular soils (Unit 4A) is 20 feet and in silt (Unit 3) is 12 feet. This separation is required to prevent pollution of the existing potable water supply.

ORKNEY (Cont'd.)

Growth Limitations:

Further development of the community, based on individual wells and septic tile fields, could be permitted. The Unit 4A soils are the most suitable for low density development with lot sizes of 0.50 acres minimum, providing the water table is at least 20 feet from ground surface.

The surficial drainage features appear to be influent (groundwater contributing to feature) and, as such, tile field construction should not be allowed within 200 feet of the edge of the features.

Based on low density development within the Unit 4A soils, individual wells and septic disposal systems, Orkney could increase to a total population of 200 - 300 persons.

ROCKTON

The community of Rockton is located approximately 3 miles west of the junction of Highways 5 and 52 on Highway 8, in the Township of Flamborough, Concession 4, Lots 20 and 21. The approximate population is less than 100 persons.

Surficial Geology, Drainage and Topography:

Fine silty sands (Unit 4A) cover most of the area, although west and north of the settlement, the overburden is very shallow and consists of a thin layer of granular till (Unit 7). The soils are well drained with the exception of one small organic area (Unit 1). Two small streams carry surface run-off, southerly to a tributary of the Fairchild Creek. The land is gently rolling, as indicated on Plan No. 16.

Water Supply:

The community is presently served by private individual wells. The majority of the domestic wells obtain their supply from the fractured dolomite, located at depths ranging from 20 to 100 feet. Several areas of bedrock outcropping in the immediate vicinity of Rockton were encountered during recent field visits. Other wells obtain water from overburden granular aquifers. The potential for yields up to 100 g.p.m. from the bedrock is good but, for higher yields, the potential is poor. Indications are that the groundwater is imperfect for domestic use and subject to contamination as a result of the shallow overburden.

Sewage Disposal:

The community is served by private septic tank and tile field systems. There is very little overburden over bedrock and a recent subdivision proposal was reviewed by the Regulatory Agencies and it was recommended that substantial earth fill be placed to increase the overburden layer to

ROCKTON (Cont'd)

facilitate the use of conventional septic tank systems. The granular till and fine granular soils (Units 4A and 7) have fair to good permeability and percolative capacity, whereas the organic soil area (Unit 1) is not suitable for septic fields. Drill hole data indicates that the overburden static water levels range from 4 to 30 feet from ground surface. When constructing septic tile field systems in fine granular soils (Unit 4A), the suggested minimum depth to bedrock is 20 feet. Prior to considering tile field construction, testing should be carried out to a minimum depth of 20 feet to determine bedrock and overburden groundwater conditions.

Growth Limitations:

The imperfect water quality and the possible contamination of present groundwater sources, indicate that this community should not experience significant growth beyond its present limits.

Only very minor community expansion and infilling could be permitted to occur, based on individual wells and sewage disposal systems. The recommended lot sizes for growth within the Unit 4A soils is 1.0 acres minimum to provide adequate separation between individual wells and tile fields. Further, the drainage features appear effluent (groundwater contributes to feature) and tile field construction should not be allowed within 200 feet of the edge of the feature.

SHEFFIELD

Sheffield is located at the junction of old Highway 8 and Regional Road 35, in the Township of Flamborough, in Concession 6, Lots 6, 7 and 8. The approximate population is less than 100 persons.

Surficial Geology, Drainage and Topography:

The eastern portion of the Sheffield area is covered by lacustrine clay (Unit 2). A band of clay till (Unit 5) separates the clay soils (Unit 2) from the western area of shallow till over bedrock (Unit 7). Although there is only one drainage course through the area which is tributary to the Fairchild Creek, the land is well drained and there are no organic features. The ground surface is flat to very gently rolling with no slopes in excess of 10% as shown on Plan 16.

Water Supply:

Private individual wells are presently used to supply water to the community. Available data indicates that all domestic wells obtain their water from fractured dolomite which is located at depths ranging from 1 foot to 30 feet from ground surface. Due to the high water table level and the shallow overburden, there is the possibility of contamination of the groundwater supply by salt from the road surfaces and tile field effluent. The potential for yields up to 100 g.p.m. from the fractured dolomite is good, while the potential for higher yields is poor. However, available data indicates that groundwater quality is generally not suitable for domestic purposes as a result of its high mineral content.

Sewage Disposal:

Private, individual septic tank and tile field systems are presently used to serve the community. The surficial clay soil (Unit 2) has poor permeability and percolative capacity, while the clay till

SHEFFIELD (Cont'd.)

(Unit 5) has poor to fair permeability and percolative capacity. The suggested minimum depth to bedrock or perched water table for tile field construction is the clay or clay till areas (Units 2 and 5) is 12 feet.

Growth Limitations:

Future growth of Sheffield will depend largely upon the soil type at the proposed septic tank and tile field location.

Septic tile field construction should not be allowed within the Unit 7 soils (shallow granular till over bedrock), since available data indicates overburden thicknesses to be less than 10 feet. Development within the Unit 2 soils could be allowed on 2-acre lots, but significant growth is not recommended.

The surficial drainage feature which cuts through the clay area (Unit 2) appears to be an effluent type (feature contributing to groundwater) and construction of septic fields should not be allowed within 50 feet of the edge of the feature.

The most favourable area for septic field construction is the clay till (Unit 5) because of the slightly higher permeability and percolative capacity of the soil. Recommended minimum lot sizes for development within this soils unit is 1.5 acre. However, depth to bedrock and depth to perched water table would have to be determined prior to considering the construction of septic tile fields.

Significant growth within Sheffield is largely restricted by the relatively limited areal extent of Unit 5 soils and the large lot sizes

SHEFFIELD (Cont'd.)

required for Unit 2 soils. Based on individual wells and septic disposal systems, Sheffield could experience growth to approximately 200 persons with the proviso that adequate separation between the ground surface and groundwater table is attained with continued acceptance of a highly mineralized water supply by residents.

STRABANE

Strabane is located 6 miles south of Highway 97 on Regional Road 4, within the Township of Flamborough, Concession 7, Lot 7. The population is approximately 100 persons.

Surficial Geology, Drainage and Topography:

Strabane is located in a complex area of granular till (Unit 6), outwash sand and gravel (Unit 4A and 4B) and organic material (Unit 1). The organic areas (Unit 1) are low lying and generally adjacent to or connected to the two creeks that flow through the community. The coarse gravel (Unit 4B) to the south is separated from the sand and gravel (Unit 4A) in the north by a band of granular till. The organic soils, as well as some areas of till and granular soil adjacent to the two streams, are poorly drained. The rest of the granular and till areas are well drained. The topography is gentle to moderately rolling in the west and southeast but there are steep slopes in the northeast associated with the drumlin and watercourse, which is tributary to the Bronte Creek. These features are shown on Plan No. 17.

Water Supply:

The area is presently served by private, individual wells. The majority of the domestic wells obtain water from the fractured dolomite located at depths ranging from 7 feet to 10 feet from ground surface. Other wells obtain water supply from the granular overlying the bedrock. The primary aquifer is the fractured dolomite and available data indicates that the groundwater quality is suitable for domestic purposes. The potential for yields up to 100 g.p.m. from the fractured dolomite is good, while the potential for higher yields is poor. Gravel operations southeast of Strabane have caused expressions of concern from several residents concerning their water supply; however, interference has not been confirmed. Interference, in this case, implies the lowering of the water table and possible contamination of the groundwater supply.

STRABANE (Cont'd)

Sewage Disposal:

The settlement is served by private septic tank and tile field systems. The organic and poorly drained areas of till and granular soil (Units 1, 4AC & 6C) adjacent to the watercourses, are not suitable for tile field construction. Although the granular and granular till soils (Units 4A, 4B and 6) found throughout much of the area have fair to good percolative capacities, some of these areas have bedrock within 20 feet of ground surface. The perched static water level is generally found from 10 feet to 14 feet from ground surface in the granular overburden overlying bedrock areas.

Growth Limitations:

The most suitable area for low density development is the granular till (Unit 6) because the percolative capacity of the soil is lowest, thereby minimizing the possibility of pollution of a perched groundwater. Development within this soils unit should be based on individual wells and septic tile fields with minimum lot sizes of 1.25 acres. This lot area requires that all wells be developed in the bedrock as there is a concern that the overburden aquifers could become contaminated by the tile fields. Alternatively, utilization of shallow wells for water supply will restrict the permissible development and larger lot areas will be required. The creeks which flow through the area are influent drainage features (groundwater discharging into feature) and tile fields should not be constructed within 200 feet of the edge of these features.

The Unit 6 soils and the bedrock aquifer are capable of supporting future growth in Strabane and could result in an ultimate population of 300 to 500 persons within the community. Infilling within the other soils units, excepting Units 4AC and 6AC, could be permitted on recommended minimum lot sizes of 0.5 acres, with individual wells and septic disposal systems, providing a minimum separation of 20 feet exists between ground surface and water table.

TROY

Troy is located 5 1/2 miles west of the junction of Highways 5 and 52. Troy is within the Township of Flamborough, Concession 3, Lot 8. The population is approximately 50 persons.

Surficial Geology, Drainage and Topography:

The soils are predominantly fine silty sands (Unit 4A), although clays (Unit 2) line the bottom of the Fairchild Creek. The area is well drained by the Fairchild Creek and the several small drainage channels which flow into it. Generally, the terrain has slopes of 0%-10%, although there are areas of 10%-20% slopes surrounding the community, as shown on Plan No. 17.

Water Supply:

The area is presently served by private individual wells, most of which obtain their water supply from the fractured dolomite located at depths ranging from 10 feet to 120 feet from ground surface. The potential for yields up to 50 g.p.m. from the fracture dolomite is good, but the potential for higher yields is poor. Available data indicates that the groundwater is generally not suitable for domestic use due to high sulphate concentrations.

Sewage Disposal:

The settlement is serviced by private individual septic tank and tile field systems. The fine silty sands (Unit 4A) have fair permeability and percolative capacity, while the clay soils (Unit 2) have poor permeability and percolative capacity. The suitability of this 4A soils unit is reflected in the fact that there have been no reports of tile field failures. Drilling data indicates bedrock may be found within 10 feet of ground surface in some areas, but no data is available to indicate overburden groundwater conditions.

TROY (Cont'd.)

Growth Limitations:

Groundwater quality is the major condition which will restrict future growth of Troy as the Unit 4A soils are capable of supporting an expanded community of up to 200 persons based on individual wells and septic tile fields. Community expansion should occur on 0.5 acre minimum lots within the Unit 4A soils and tile field construction should not be allowed within 50 feet of the edge of the drainage features, since they are effluent type features. However, the poor water quality (high sulphates) of the groundwater will tend to restrict further development.

WESTOVER

Westover is located in the Township of Flamborough, on Regional Road 20, approximately 7 miles of the Town of Dundas. It has a population of approximately 50 persons.

Surficial Geology, Drainage and Topography:

The soils surrounding Westover are a complex variety of clay till (Unit 2), granular (Unit 4A & 6) and organic (Unit 1) soils. The fine granular soils (Unit 4A) predominate the east half of the area and surround the granular till soils (Unit 6) of the drumlins. The western portion of the community, with the exception of one drumlin of granular till, is covered largely by organic soils (Unit 1) and shallow granular till (Unit 7) over bedrock. Soil depths over most of the community area, except for the three drumlins, are fairly shallow (generally less than 20 feet), particularly in the Unit 7 areas (less than 10 feet). The land is generally well drained with the exception of the organic soil (Unit 1) adjacent to the watercourse west of Westover Road and the poorly drained granular tills (Unit 7C). The watercourse is tributary to Spencer Creek. The three drumlins which dominate the community have side slopes of 10% to 20%, while the rest of the area is flat lying to gently rolling, with slopes of 0% to 10%, as shown on Plan No. 18.

Water Supply:

Private individual wells supply the settlement's water needs. All wells obtain their supply from the fractured dolomite located at depths ranging from 2 feet to 50 feet from ground surface. The potential for yields up to 100 g.p.m. from the fractured dolomite is good, but the potential for higher yields is poor. Available data indicates the groundwater is suitable for domestic purposes.

Sewage Disposal:

Individual septic tanks are utilized for the disposal of sewage in Westover. The organic soils (Unit 1) and the poorly drained granular till soils (Unit 7C) are not suitable for tile fields. The clay soils (Unit 2)

WESTOVER (Cont'd.)

the granular tills (Units 6 & 7) and the fine granular soil (Unit 4A), have poor, fair and good permeability and percolative capacities, respectively, while the coarse granular soil (Unit 4B) has good to excellent characteristics. When considering the construction of tile field in areas of bedrock or perched water table, the suggested minimum distance to bedrock or a perched water table in coarse grained soils (Units 4A, 4B & 6) is 20 feet and in fine grained soils (Unit 2) is 12 feet.

Growth Limitations:

The areas most suitable for future growth within the community of Westover are the Unit 4A soils, located generally east of Westover Road and south of the 6th Concession Road. This area is void of organic deposits and the ground slopes are gentle.

West of Regional Road 20 (Westover Road), the lands consist mainly of organic deposits (Unit 1), shallow granular till over bedrock (Unit 7), clays (Unit 2) and some areas of granular tills (Unit 6). These soils categories are generally unsuitable for development, with emphasis on the unsuitability of the organic soils for tile field installation. However, this area could support minor growth on 2.0 acre lots through infilling, but generally the area should not be considered for any significant development.

The organic soils areas (Unit 1) and the wet granular till areas (Unit 7C) are considered to be influent features (groundwater contributing to feature) and tile fields should not be installed within 200 feet of the edge of the feature.

WESTOVER (Cont'd.)

North of the 6th Concession Road and east of Regional Road 20, the soils categories are suitable for development, but ground slopes restrict the usefulness of the lands for residential growth. Limited expansion in this area could be permitted, based on individual wells and septic disposal systems on 1.25 acre lots. Large scale development in this area should not be considered.

East of Regional Road 20 (Westover Road) and south of the 6th Concession Road, as described previously, is the best suited area for significant growth of the community. Groundwater supplies are sufficient for such growth and, based on individual wells and septic tile fields, Westover could experience additional growth of up to 150 persons, within the Unit 4A soils for an ultimate community of 200 persons. However, these soils require a minimum separation of 20 feet between the aquifer and/or bedrock and the ground surface.

TOWNSHIP OF GLANBROOK

BINBROOK

Binbrook is located at the intersection of Highway 56 and Regional Road 22, approximately 6 miles from the built-up area of the City of Hamilton, in the Township of Glanbrook. The present population is approximately 350 persons.

Surficial Geology, Drainage and Topography:

The soils are largely clay tills (Unit 5) with some surficial silty clays (Unit 2) in the south central area. The southern portion of the community drains south through a network of several intermittent watercourses to the Welland River.The northern portion of the community drains northerly to Twenty Mile Creek. Ground slopes in the immediate area of the community are less than 10% as shown on Plan No. 19. All drainage features appear of the effluent type (contributing to groundwater) and septic field construction should not be allowed within 50 feet of the feature.

Water Supply:

Private individual wells supply the water needs of the area, with the majority of domestic wells obtaining their supply from the fractured dolomite located at depths ranging from 50 feet to 90 feet from ground surface. The overburden wells in the area obtain their water supply from a granular aquifer, up to 10 feet in thickness, overlying the bedrock. The potential for yields up to 100 g.p.m. from the fractured dolomite is good, while the potential for yields of up to 150 g.p.m. is fair. However, the quality of the groundwater in some areas of the community is hard, high in iron and sulphates, and has excessive concentrations of sulphides. In these areas, many people use rainwater from cisterns for laundry and bathing purposes. Also, a recent survey of a number of wells in the area indicated a large percentage of existing wells with high bacteriological counts.

BINBROOK (Cont'd)

Sewage Disposal:

Private, individual septic tanks and tile fields are the main form of sewage disposal in the area. There have been reports of domestic waste being found on the bottom of the drainage ditch running through the hamlet, but the source has not been identified. The clay till soils (Unit 5) have poor to fair permeability and percolative capacity, and the silty clays (Unit 2) have fair permeability and percolative capacity. Available data does not indicate water table conditions in the overburden; however, it is recommended that a minimum depth of 12 feet from ground surface to the water table in the clay or clay till should exist in proposed tile fields areas.

Growth Limitations:

The existing contaminated wells are generally indicative of a polluted water source caused by improper separation of septic tile fields from the groundwater source or poor well construction techniques.

The bedrock aquifer supply appears to be highly mineralized and thus unsuitable for a communal well system.

Thus, further growth of the community, based on the use of private individual wells, is not recommended.

The existing soils conditions (Units 2 and 5) within the community are generally considered marginal with regard to development on septic tile fields. The apparent failures of existing tile fields within the community support this and it is recommended that existing problems be corrected prior to further development.

Further, the large number of small intermittent watercourses which should be isolated from tile field systems, effectively removes large areas adjacent to existing development from further development.

BINBROOK (Cont'd.)

Significant growth beyond the present community is not recommended unless full municipal services (sanitary sewerage and water supply) are provided. Extension of the Regional sanitary sewage collection system from the Town of Stoney Creek could permit expansion of the community and rectification of existing problems. Similarily, water supply for the existing and expanded community could be obtained through extensions of the Regional water system in Stoney Creek. A discussion of the servicing options for Binbrook is included in Appendix "E".

DICKENSON ROAD AREA

This settlement is located in the Township of Glanbrook on Regional Road 53, approximately 4 miles from the built-up area of the City of Hamilton. The present population is approximately 250 persons and comprises strip development along Regional Road 53, Dickenson Road and Twenty Road West. The boundaries of the community are not finite and for the purpose of this study, it has been assumed that the area under study is the development at the intersection of Regional Road 53 and Dickenson Road, but not including the strip development along Twenty Road West.

Surficial Geology, Drainage and Topography:

The surficial geology consists of lacustrine silty clay (Unit 2) in the area south of Twenty Road West. The soils are generally well drained with the area north of Dickenson Road flowing to a tributary of the Twenty Mile Creek, while south of Dickenson Road the lands drain to the Welland River. While some isolated portions of the intermittent stream banks have slopes in excess of 10%, the land is gently rolling with surface slopes of less than 10%. These features are shown on Plan 19.

Water Supply:

Private, individual wells provide water to the settlement. The majority of the wells obtain their water from fractured dolomite located at depths ranging from 40 feet to 100 feet from ground surface. Others obtain their water supply from a granular aquifer within the overburden and the depth of overburden well ranges from 25 feet to 40 feet. Overburden wells have static water levels ranging from 3 feet to 26 feet from the ground surface, but some drill hole logs indicate that the static water levels reflect the water level of the surrounding soil and are, generally, not a result of artesian head within the aquifer. Because the fractured dolomite is the primary groundwater source and the data indicates that its hydrostatic head does not appear to influence the granular aquifer, the overburden groundwater had been classed as a perched condition. Both the overburden and bedrock aquifers indicate that the potential for groundwater yields up

DICKENSON ROAD AREA (Cont'd)

to 50 g.p.m. is good, but the potential for higher yields is poor. Available information indicates that the groundwater quality is sufficient for domestic use, but it is anticipated that pollution problems do exist, as a result of poor well construction techniques and inadequate seals at the ground surface.

Sewage Disposal:

Private, individual septic tanks and tile bed systems are the main form of sewage disposal in the area. The silty clay (Unit 2) has poor to fair permeability and percolative capacity. When considering tile field construction, the minimum depth to groundwater in a clay soil (Unit 2) should be 12 feet. Prior to construction, the depth to the groundwater level in the overburden should be determined during the spring months when the water table is highest.

Growth Limitations:

The existing Unit 2 soils in the area suggest that lot sizes for future development be 2.0 acres minimum in area to accommodate the percolation rates of the silty clay. The apparent high perched water table, combined with its use as a water supply for a number of the existing residents, restricts the areas which should be considered suitable for future development based on individual private wells and septic disposal systems.

The extent of the strip development, within the community, would make the installation of a communal well and supply system an expensive proposal, in order to permit further development on septic systems. Although no well pollution problems have been reported, further development in areas of high water table will, undoubtedly, cause pollution of the perched water table source.

DICKENSON ROAD AREA (Cont'd.)

On the basis of soils types and water supply, it is recommended that the Dickenson Road area experience very limited growth utilizing individual wells and septic tile fields. Should detailed investigation indicate that adequate separation (in this case 12 feet minimum) exists between the ground surface and the perched water table, infilling could be permitted. In addition, since the surficial drainage features appear of the influent type (groundwater contributing to feature), tile field development should not be allowed within 200 feet of these features. In all cases of growth, it is further recommended that drilled wells to bedrock aquifer be used.

MOUNT HOPE

Mount Hope is located at the intersection of Highway 6 and Regional Road 37, (Airport Road), in the Township of Glanbrook, 5 miles from the built-up area of the City of Hamilton. It has a population of approximately 900 persons.

Surficial Geology, Drainage and Topography:

The Mount Hope area is covered by lacustrine silty clays (Unit 2) and is located in a headwater zone. The soils in the majority of the area are well drained by several small streams, with the southerly area draining to the Welland River and the northerly area to Twenty Mile Creek. Except as noted on Plan No. 20, the lands around the Airport have no apparent drainage courses and will be subject to a temporary high water table condition during times of heavy precipitation or snow melt. The land surface is generally flat to gently rolling with most slopes being less than 10%. However, there are areas of 10% to 20% slopes along the sides of some of the major intermittent water courses.

Water Supply:

Mount Hope has no municipal water service although a 6" diameter water main connected to the City of Hamilton system services the Hamilton Municipal Airport, located just west of the hamlet. To date, there have been only 3 private connections made to the main as the water quality is unsatisfactory and is not considered suitable for future connections. The unsatisfactory water quality is reportedly due to the condition of the supply main, which has many leaks and, during times of essentially zero internal pressure, is contaminated by the high groundwater table. All water is chlorinated at the airport to ensure potable quality within the airport limits.

MOUNT HOPE (Cont'd.)

The majority of the homes obtain their water supplies from individual private wells. Some wells obtain their water from the granular material overlying bedrock, which ranges in thickness from 2 to 10 feet. Of 139 wells recently sampled, 123 were found to be satisfactory in quality, although 50% of the residents reported shortages of water. A number of residents supplement their supplies with rain water from cisterns or have had water hauled in. The most severe water shortages were reported by residents along Homestead Drive and Airport Road. The potential for yields of up to 25 g.p.m. from the bedrock aquifer is good, but the potential for yields of up to 50 g.p.m. is only fair.

Sewage Disposal:

Private, individual septic tank systems are the means of sewage disposal in the community. The silty clay (Unit 2) has poor to fair permeability and percolative capacity and the suggested minimum depth to groundwater when considering the installation of tile fields in silty clay is 12 feet. There does not appear to be any evidence of high water table within the area other than potential seasonal variations in the area of the Mount Hope Airport.

Growth Limitations:

Future growth of Mount Hope is restricted by current water shortages, together with the fact that in some cases the water is of unsuitable quality. This presents a strong argument for the installation of a municipal water supply capable of meeting the demands of the Airport and residential development. The existing main from the City of Hamilton is in poor condition and will require replacement to provide adequate capacities for existing and future growth of domestic, industrial and fire protection requirements. The availability of a municipal water system could

MOUNT HOPE (Cont'd.)

result in an increase in the problems with sewage disposal and, in consideration of the present size of the community, it is suggested that with the adoption of a program to encourage growth, a sewage collection system should be provided outletting to the Hamilton system.

Infilling and minor community expansion beyond the present situation is not recommended unless an adequate water supply can be assured. In the event that minor growth on septic tile fields is permitted, the construction of tile fields should not be allowed within 50 feet of the edge of the effluent drainage feature and lot areas of at least 2.0 acres should be provided for all future residential development, should septic tank and tile field systems continue to be utilized for sewage disposal.

WOODBURN

Woodburn is located on Regional Road 34, 1 3/4 miles south of Highway 20, in the Township of Glanbrook. The present population is approximately 200 persons.

Surficial Geology, Drainage and Topography:

The soils in the central and northwestern parts of the community are lacustrine silty clays (Unit 2). Clay till (Unit 5) covers the southern and northeastern areas. The area drains to the east through several intermittent drainage courses to the Twenty Mile Creek. The soils are generally well drained but, during heavy precipitation, low areas adjacent to the Twenty Mile Creek will have a high water table condition. The land surface is flat-lying with slopes generally less than 10%, as shown on Plan No. 21.

Water Supply:

Individual private wells supply the water needs of the hamlet with many wells obtaining their domestic supply from fractured dolomite, located at depths ranging from 15 feet to 50 feet from ground surface. The newer homes in the area generally use drilled wells while some older homes rely on dug wells. The potential for yields or up to 25 g.p.m. from the fractured dolomite is good, while for yields up to 50 g.p.m. the potential is fair. Available data indicates that the groundwater quality is suitable for domestic purposes, although, in some instances there are reports that the water is hard with a high iron and sulphate content. The homes experiencing poor water quality generally rely on rainwater stored in cisterns for laundry and bathing purposes.

Sewage Disposal:

The disposal of sanitary wastes is generally through the use of individual private septic tank and tile field systems. The clay till soils

WOODBURN (Cont'd.)

(Unit 5) have poor to fair permeability and percolative capacity, while the silty clays (Unit 2) have fair permeability and percolative capacity. Available data does not indicate a water table condition within the overburden; however, water table levels should be evaluated prior to septic field construction. The minimum depth to the top of overburden groundwater table for clays and silty clays is 12 feet.

Growth Limitations:

Generally poor water quality, as well as poor soil conditions for disposal of effluent from septic tanks will restrict any major development in this community and only a minimum amount of growth should be considered.

The apparent limited capacity of the fractured dolomite aquifer for communal well supply, suggests that any future development within Woodburn should proceed with private drilled wells. The existing soils conditions in and around Woodburn are generally considered marginal with regard to development potential relative to other soils types. The Unit 2 soils are suitable, only for very low density type development, with the recommended lot sizes being 2.0 acres minimum. The Unit 5 soils are also suited only to low density development on 1.5-acre lots.

The surficial drainage features appear to be of the effluent type (contribute to groundwater) and tile fields should not be constructed within 50 feet of the edge. In low areas, adjacent to the Twenty Mile Creek, seasonal variations in the depth to the overburden groundwater should be assessed prior to any tile field construction in these areas to ensure that contamination of the water table does not occur.

WOODBURN (Cont'd.)

Restricted growth is recommended for Woodburn since the community has already reached the recommended population for the soil and aquifer conditions present within the community. Accordingly, only very limited community expansion should be permitted within either soil unit.

TOWN OF STONEY CREEK

TAPLEYTOWN

Tapleytown is located approximately 5 miles southeast of Hamilton, in the Town of Stoney Creek, at the intersection of Regional Road 11 and Regional Road 34, Concession 7, Lot 16. It has a population of approximately 100 persons, with the majority of the population in the Gilman Gardens subdivision located west of Regional Road 34.

Surficial Geology, Drainage and Topography:

The soil in the Tapleytown area is a clay till (Unit 5). The soils are generally well drained with excess run-off flowing to the east and northeast along several intermittent streams, with the exception of the Gilman Garden subdivision, where surface drainage is generally poor. The land surface is flat to very gently rolling with no slopes in excess of 10%, as shown on Plan No. 22.

Water Supply:

The community is served by private individual wells. All wells obtain their domestic water supply from fractured dolomite at depths ranging from 5 feet to 30 feet from the ground surface. The potential for yields of up to 25 g.p.m. from the fractured dolomite is good, while the potential for higher yields is poor. The available data indicates that groundwater quality is unsatisfactory for domestic use. The poor quality of the groundwater is evident from the use of cisterns within the Gilman Garden Subdivision, located north of Regional Road 11 (Mud Street), west of Third Road East. Many wells within the subdivision are subject to surface water contamination due to inadequate construction techniques, generally being the lack of proper sanitary seal at the top of the well.

Growth Limitations:

Future growth of the community should be restricted to infilling. The Unit 5 soils require lot sizes of 1.5 acres due to the percolative capacity of the soils.

TAPLEYTOWN (Cont'd.)

The poor water quality will further restrict expansion of the community and it is recommended that only low density expansion be permitted and no major development proposals should be considered for this area.

Drainage features appear to be effluent type (feature contributing to groundwater) and septic fields should not be constructed within 50 feet of these features.

VINEMOUNT

Vinemount is located at the intersection of Regional Road 25 and the Eighth Road east, in the Town of Stoney Creek. It has a population of less than 100 persons.

Surficial Geology, Drainage and Topography:

Vinemount is located mainly on clay till soil (Unit 5) with shallow overburden and exposed bedrock on the face of the escarpment. The soils are well drained with excess run-off carried down the escarpment by two small streams. The Niagara Escarpment, with slopes in excess of 20%, is the dominant topographic feature in this community separating the flat-lying lowland from the upland plains, as shown on Plan No. 22.

Water Supply:

The community is presently served by private individual wells. All wells obtain their domestic water supply from fractured dolomite which ranges from 12 feet to 30 feet from ground surface. The potential for yields up to 25 g.p.m. from the fractured dolomite is good, while the potential for yields up to 50 g.p.m. is fair. The groundwater is poor quality with a high sulphate content. The existing wells within the community have generally very low yields and many homeowners purchase water for cisterns.

Sewage Disposal:

Individual septic tanks are the main form of sewage disposal in the area. The clay till area (Unit 5) has poor to fair permeability and percolative capacity while the granular till area (Unit 7) has fair permeability and percolative capacity. The available data does not indicate a water table condition within the overburden; however, prior to tile field construction the area should be evaluated for groundwater conditions within the top 20 feet of the overburden. The recommended minimum depth to groundwater

VINEMOUNT (Cont'd)

for a clay till is 12 feet. The shallowness of the granular till suggests that this area should not be developed on the basis of septic tank system for sewage disposal.

Growth Limitations:

The existing soils (Unit 5) that exist over the largest portion of the area are generally considered marginal with regard to development potential. For community expansion within this unit, lot sizes of 1.5 acres are recommended. The Unit 7 soils, located along the edge of the escarpment may have local areas suitable for development on 1.25 acres lots, but the influent condition of the Niagara Escarpment (groundwater draining towards escarpment) suggests that tile fields be at least 200 feet from the edge of the feature. This restriction, in effect, eliminates this soils Unit from consideration for future development. The poor water quality and the soils condition in the area limit the development potential of the community. Very restrictive community expansion could take place, utilizing individual wells and septic tile fields, but major development should not be considered. Accordingly, the upper population of the community should not exceed 200 persons within the area shown on Plan 22.

SPECIAL STUDY AREAS

Generalized Development Suitability (Plan 3)

To determine the location of areas most suitable for new development, both Groundwater Quality and Quantity and Septic Disposal Suitability were considered. With respect to groundwater and septic disposal methods, only areas with Unit A or Unit B septic rating and those areas with a minimum Unit 2 Water rating were considered. On this basis, the following 3 areas were chosen. It should be noted that other considerations should be applied in the examination of these areas relative to settlement capability, specifically in reference to agricultural lands, environmental sensitive areas and transportation considerations.

Study Area 1:	Unit A	Septic Disposal
	Unit 4	Groundwater Probability
Study Area 2:	Unit A	Septic Disposal
	Unit 3	Groundwater Probability
Study Area 3:	Unit B	Septic Disposal
	Unit 2	Groundwater Probability

Regarding municipal water supply requirements, Area 1 has the potential for the highest groundwater yields, with Area 2 having a lesser potential and Area 3 being the minimum potential considered. The most significant difference between the areas is that Areas 1 and 2 have good soil capacity for septic disposal, while Area 3 has soils of lower permeability requiring larger lot sizes.

The intent of Plan 23, Generalized Development Suitability, is to define areas most suitable for major development. This does not preclude the possibility of settlements in areas other than those indicated, since minor developments are possible on individual well systems in most areas throughout the Region. Domestic wells can be developed in Units 2,3,4, &5 (Plan 1 Generalized Groundwater Probability) with fair to good probability.

Within Unit 1, however, there is very low probability that a domestic supply can be obtained. Water quality must also be considered for minor developments other than within Areas 1,2, &3 (Plan 23).

STUDY AREA #1

Study Area #1 is located in the Township of Flamborough, northeast of Highway 6, as shown on Plan 23.

The following discussion applies to the existing undeveloped areas and is not intended to describe the existing communities.

Surficial Geology and Drainage:

The area is covered largely by granular soils (Unit 4A) with some organic (Unit 1) and till deposits (Unit 6). There is a band of organic material in the centre of the area and is surrounded by clay tills (Unit 5) and granular tills (Unit 6 and 7).

While there are only a few small drainage channels tributary to Grindstone Creek, most of the soils are well drained, with the exception of the organic high water table feature (Unit 1) and some areas of high water table sands (Unit 4AC).

Topography:

The area is essentially flat-lying with no slopes in excess of 10%.

Water Supply:

The majority of domestic wells in the area, obtain their supply from fractured dolomite and shale generally located at depths ranging from 25 to 60 feet from ground surface.

The potential for yields up to 50 g.p.m. from the bedrock aquifer is good, while the potential for yields up to 100 g.p.m. is only fair. The potential for obtaining a yield of 200 g.p.m. from a multiple well system is good. Available data indicates that groundwater quality is sufficient for domestic purposes.

STUDY AREA #1 (Cont'd.)

Sewage Disposal:

The coarse granular (Unit 4B) and the fine granular (Unit 4A) soils have good permeability and percolative capacity, while the clay till (Unit 5) and granular till areas (Unit 7) have poor to fair characteristics.

Available data indicates that groundwater within the overburden is found at approximately 20 to 25 feet from ground surface and, as such, it is recommended that testing be carried out to accurately determine the separation between ground surface and water table.

Growth Limitations:

The apparent bedrock aquifer capacity is capable of supplying a population of between 500 and 750 persons, based on a single communal well installation. Should development be considered for this area, it is recommended that the minimum lot size be set at 0.50 acres and 1.50 acres for Unit 4A and 5 soils respectively, with only low density development being considered.

The Unit 4A soils are the most suitable for development on individual wells and septic tile field systems. The recommended minimum separation between ground surface and water table within Unit 4A and 4B soils is 20 feet. The surficial drainage features appear to be effluent (feature contributing to groundwater) and tile fields should not be constructed within 50 feet of the edge of the feature.

The organic areas (Unit 1) and wet fine granular areas (Unit 4AC) are not suitable for septic field installation. The features appear influent in that they reflect groundwater conditions and tile field installation should not be allowed within 200 feet of theedge of the feature.

STUDY AREA #1 (Cont'd.)

In conclusion, should development be considered desirable in this area, it is recommended that individual water supply and sewage disposal systems be installed and that the ultimate population be limited to 500 persons. We would not suggest a development limit of 750 persons as indicated by the aquifer assessment due to the need to assess the actual conditions relative to development type and extent. Accordingly, during the time of development, the suggested limit should be reviewed relative to the actual operating result of the water and sweage systems and adjusted as conditions may allow.

STUDY AREA #2

Study Area #2 is located west of Highway 52, generally between Highways 2 and 99, partially within the Township of Flamborough, and partially within the Town of Ancaster, as shown on Plan 23.

The following discussion applies to the existing undeveloped areas and is not intended to describe the existing communities.

Surficial Geology:
The area is located on a plain of lacustrine silty sand (Unit 4A). However, there may be areas of silty clay or clayey silt within the sand plain. Silty clay (Unit 2) lines the bottom of some of the drainage features.

Topography:
The area is gently rolling with most slopes being 0% to 10%, however, there are several areas where ground slopes are 10% to 20%.

Water Supply:
The majority of wells in the area, obtain their supply from fractured dolomite located at depths ranging from 150 to 200 feet from ground surface. Some farms in the area obtain their domestic supply from perched overburden aquifers ranging in depth from 10 to 30 feet from the ground surface. These aquifers appear to be of limited areal extent and offer little in the way of potential capacity.

The probability of obtaining a yield of up to 100 g.p.m. from the bedrock aquifer is good, while the probability of obtaining a yield of up to 150 g.p.m. is fair. Available data indicates the groundwater is generally suitable for domestic use.

STUDY AREA #2 (Cont'd.)

Sewage Disposal:

The fine granular (Unit 4A) and the coarse granular (Unit 4B) soils have good permeability and percolative capacity.

Growth Limitations:

The apparent bedrock aquifer capacity is capable of supplying a population of up to 1000 persons, based on a communal well installation. Should development be considered for this area, it is recommended that the minimum lot size be set at 0.5 acres for Unit 4A and 4B soils with only low density development being considered. The entire area is generally suitable for development on individual wells and septic tile field systems, although the several areas would require groundwater investigation to determine the separation between ground surface and water table. The recommended minimum separation between ground surface and water table within Unit 4A soils is 20 feet. The surficial drainage features appear to be effluent (feature contributing to groundwater) and tile fields should not be constructed within 50 feet of the edge of the features.

In conclusion, should development be considered desirable in the areas, it is recommended that individual water supply and sewage disposal systems be installed and that the ultimate population be limited to 500. We would not suggest a development limit of 1000 persons as indicated by the aquifer assessment due to the need to assess the actual conditions relative to development type and extent. Accordingly, during the time of development, the suggested limit should be reviewed relative to the actual operating result of the water and sewage systems and adjusted as conditions may allow.

STUDY AREA #3

Study Area #3 is located south of Woodburn and west of Highway 56 in the Township of Glanbrook. The following discussion applies to the existing undeveloped areas and is not intended to describe the existing communities.

Surficial Geology:

The soils within this study are clay tills (Unit 5) with lacustrine clays (Unit 2) lining portions of the larger stream channels as shown on Plan 23.

Topography:

The area is essentially flat-lying with slopes generally less than 10%.

Water Supply:

The majority of domestic wells in the area, obtain their supply from fractured dolomite and shale located at depths ranging from 70 to 90 feet from ground surface. The overburden wells in the area obtain their supply from a granular aquifer overlying bedrock. The maximum indicated thickness of the granular material is 10 feet.

The potential for yields of up to 100 g.p.m. from the bedrock aquifer is good, while the potential for yields up to 150 g.p.m. is only fair. Available data indicates that groundwater quality is sufficient for domestic purposes; however, occassionally, a drilled well will encounter groundwater having noticeable sulphate content. It appears that the best quality water may be found at the bedrock surface.

Sewage Disposal:

Very limited development has occurred in this area with the exception of Binbrook and, consequently, septic tile fields have not been overloaded.

STUDY AREA #3 (Cont'd.)

The clay till soils (Unit 5) have poor to fair permeability and percolative capacity. Available data does not indicate water table conditions in the overburden; however, it is recommended that testing be carried out to determine if the suggested 12 foot separation from ground surface to water table exists, prior to tile field installation.

Growth Limitations:

The bedrock aquifer capacity is capable of supplying a population of up to 1000 persons, based on a communal well installation. Should development be considered for this area, it is recommended that the minimum lot size be 2.0 acres and 1.5 acres, for Units 2 and 5 respectively, with only low density development being considered. Except for drainage features, the area is generally suitable for development on individual wells and septic tile field systems. The recommended minimum separation between ground surface and water table within Unit 5 soils is 12 feet. The surficial drainage features appear to be effluent (feature contributing to groundwater) and tile fields should not be constructed within 50 feet of the edge of the feature.

In conclusion, should development be considered desirable in this area, it is recommended that individual water supply and sewage disposal systems be installed and that the ultimate population be limited to 500 persons. We would not suggest a development limit of 1000 persons, as indicated by the aquifer assessment, due to the need to assess the actual conditions relative to development type and extent. Accordingly, during

the time of development, the suggested limit should be reviewed with respect to the actual operating result of the water and sewage systems and adjusted as conditions may warrant.

Respectfully submitted,

Glenn W. Harris, P. Eng.,
Project Engineer

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APPENDICES

APPENDIX 'A'

SEWAGE AND WATER SYSTEMS

General:

It is of utmost importance to adopt a servicing policy that will adequately provide future residences with water supply and sewage disposal. It is assumed, that the service level recommended for each community should not require replacement in the future with an alternative service due to malfunction of the initial facilities.

INDIVIDUAL HOUSEHOLD SEWAGE SYSTEMS

The basic types of individual household sewage disposal systems are discussed in the following sections:

1. Septic Tank Tile Field System:

This type of sewage disposal system is basis for the establishment of all lot areas suggested within the report.

Properly designed septic tank and tile field systems will, under suitable conditions, not discharge any wastes to either surface or groundwaters. The system, however, is completely dependent on the adequacy of the soil conditions and the location of the water table. In areas where the water table is close to the ground surface, even under ideal soil conditions, the system will not perform adequately, in that the effluent will reach the groundwater table and this could cause pollution of private wells or ponding on the ground surface. With very few exceptions, large systems to serve shopping centres, schools, high water use industry etc., are not considered practical due to difficulties in the maintenance and operation of the system. The conditions affecting the satisfactory construction, maintenance and operation of septic tank systems are considered to be sufficiently important

to warrant a special discussion and recommendations. This method of sewage disposal has been considered as a suitable alternative for single family homes only.

For thousands of years soils have served as disposal systems for wastes from forests and animal life. If these natural vegetable and animal wastes had not been disposed of by normal processes, vast blankets of wood and prairie hay would have smothered the land long ago. When, in the present context, people put human wastes into the ground, care must be taken not to overload the soils. Design and management must be such that the natural processes of waste disposal are permitted to work, as they have through the ages, to gradually and safely return organic materials and nutrients to the soil.

The cause of the problems that now occur with ponding of septic tank effluents or discharges to ditches or small watercourses has been a high water table or the inadequate distribution of the tank effluent over a sufficiently large area. Many studies and investigations have been carried out in Canada and the United States regarding the disposal of sewage from private dwellings. The University of Wisconsin has carried out extensive work in this area and reference to the studies by Mr. J. Bouma has been particularly valuable in the assessment of sites proposed for tile field systems, the operation of the systems and the recommendations of improvements or alternative construction programs.

The systems examined indicated that a sandy soil is not as effective as the clays for the removal of nitrogen and phosphorous. However, within the sandy soils, percolation conditions were satisfactory and ponding was not a problem, except when the trench wall and bottom became encrusted with an organic layer. This had the effect of blinding the soil so that percolation into the ground was sufficiently reduced in some locations to cause ponding. Examination of the test sites showed that holes dug adjacent to the origianl trench that had ponded, to a depth below the bottom of the original trench, were dry. However, when the trench wall was

punctured, the effluent contained within the trench flowed into the newly excavated holes and seeped rapidly away into the ground. The failure of the trench was due to the initially high percolation rate of the effluent through the sand resulting in rapid movement of the water through the ground. The suspended solids were retained at the interface between the wall and bottom of the trench and the gravel fill to the extent that build-up of solids exceeded the rate of the decomposition. The trench progressively plugged from the inlet end to the far end, to the extend that ponding occurred in time.

To avoid the reoccurrance of this problem, it may be best to either intermittently dose the field by means of a dosing chamber, or to construct duplicate tile fields that could be alternated in use every half year. While sand soil conditions are often regarded as ideal for tile field systems, they are not as efficient in the treatment of the sewage prior to its discharge to the groundwater. The pore sizes and permeability of the sand allow the liquid waste to move rapidly through the soil, but this does not give sufficient time to provide for treatment. This means that tile fields built in sandy areas should be located at greater distance away from water supply wells and groundwater table than fields in less permeable soils. Of the nutrients, nitrogen and phosphorous, nitrogen is not very effectively removed in a sandy soil. Also, the tests showed that where the groundwater table was high and flooded the tiles, pathogenic bacteria were not effectively removed and the groundwater became polluted. Furthermore, aerobic conditions in the tile field result in the production of nitrate nitrogen which can travel to the groundwater as it is not chemically bound with the soil particles. Experimentation is being carried out towards the construction of a barrier below the tile field which would result in anaerobic conditions to cause denitrifcation and achieve removal of the nitrogen through the production of gaseous nitrogen from nitrates. Phosphorous is reasonably well removed as it combines chemically with the soil particles.

Clay soils have small pore spaces and low permeability. Accordingly, while this type of soil is an efficient filter media, its capacity to accept and transmit septic tank effluent is greatly reduced when compared to a sandy soil. The formation of an organic slime layer on the walls and bottom of the original trench is less apt to occur than in the sandy soils due to the inability of the clay to allow rapid percolation of the water. Blinding of the trench walls and floor soils does, of course, occur and failure of the system takes place with a thinner layer of organic slime than in sandy soils. Anaerobic conditions are more likely to occur in a clay soil due to the slow movement of the water, resulting in the conversion of nitrogen to the gaseous form which rises to the ground surface along with other gases.

The purpose of this discussion has been to give a better understanding of the disposal process and to make a strong case for a sound design, close supervision of construction and routine inspection of the septic tank and tile field system as a method of sewage disposal.

The findings of the University of Wisconsin study indicate that this type of sewage disposal system should continue to be utilized in many communities. Accordingly, the following outlines a number of factors which should be considered in future developments, to ensure that problems which cannot be resolved on an individual basis will not occur.

1. Septic tank and tile field systems should be considered only for single family homes or units with a similar daily sewage flow.

2. A land area sufficient in size to permit duplication of the initial tile field should be provided. The use of lands reserved for this purpose should be restricted sufficiently to allow for the ready construction of the second tile field, should this become necessary. Therefore, construction of a swimming pool or other permanent structure should not be permitted in such lands.

3. The requirements for two tile fields, each of a size to suit the needs of the particular installation, should be considered in those soils where it is known that tile fields become inoperative due to the formation of slime layers along the trench walls and bottom. A splitter box should be used to manually divert the tank effluent to the other tile bed for a few months or a year, as determined through experience.

4. Tile field systems with length of tiles greater than 1000 feet should be equipped with either gravity or pumped dosing chambers.

5. Consideration of the inclusion of design approval and inspection during construction of tile field systems into the subdivision or development agreement as a normal municipal service, is suggested.

6. Annual inspection of the septic tank and the tile field is suggested, where it is considered critical. This inspection should be carried out by municipal staff to ensure that the tank is pumped out and that the second tile field is placed into operation when required.

7. A vertical separation between the maximum water table elevation and the tiles, as indicated by the soils condition, should be provided. The construction of "raised" tile fields should only be considered for those areas where it has been demonstrated that the system has worked satisfactorily. Further, the construction techniques followed should ensure minimal disturbance of the existing soils.

8. The use of household water softeners should be discouraged as the saline backwash can cause a change in the clay portion of the soil matrix and decrease the permeability of the soil.

9. Further, it is suggested that, where the individual home is to utilize both a private well and a septic system, the well should

be constructed prior to the tile field. The condition of the well should then dictate the location of the tile field; i.e. a shallow well should be located at least 100 or 200 feet away from the tile field and a deep drilled well, with the aquifer located more than 50 feet below ground surface, approximately 100 feet from the field. This suggestion is difficult to regulate on an individual lot basis. Therefore, it is suggested that the construction of the well and tile field be included in the conditions of subdivision approval and acceptance.

2. Chemical Physical Treatment Process:

These processes involve the construction of treatment tanks and the addition of chemicals to raw sewage which is allowed to settle, with subsequent removal of the sludge, and the effluent normally being passed through a sand filter. The filtering removes the major portion of the remaining suspended particles to facilitate the percolation of the water into the ground with the tile field systems. The effluent is not considered to be adequately treated, even with chlorination for disinfection, for discharge to a ditch or small watercourse.

Major limitations to the system are the need to regularly remove settled sludge, maintenance of the chemical feed (mechanical) systems, and frequent treatment plant upsets, in which case the tile fields could become plugged and inoperative.

This system is not recommended for any installations at any location.

3. Aerobic Systems:

Many manufacturers, since the early 1960's, have marketed household size aerobic treatment units as a system that would provide an improved effluent quality when compared to the normal septic tank. The biological treatment process in the plant is identical to most municipal plants. The raw sewage is discharged to an aeration chamber where it is mixed with settled sludge that has been returned from the final settling tank. The settled sludge is a bio-mass which, when in a healthy state, will oxidize the incoming organic to produce additional bio-mass or sludge

plus carbon dioxide and water. The retention time in the aeration tank normally is sufficiently long that a portion of the bio-mass itself is used to support the remainder. This extended aeration results in essentially total oxidation of the incoming organics to carbon dioxide and water. Periodically, some inert sludge must be removed (once per year) to prevent the build-up of excess amounts in the treatment system with the resultant carry-over in the final effluent. The aeration tank contents must be kept in an aerobic (excess dissolved oxygen) state at all times for the process to function properly. Should the air supply be shut off, even for a short period of time, the system will turn septic, obnoxious gases will be produced and the effectiveness of subsequent treatment units will be considerably reduced. In effect, the aeration tank will be a septic tank. The effluent from the aeration tank is directed to a settling basin where the bio-mass is allowed to settle under quiescent conditions and a pumping system returns this settled sludge back to the aeration tank. The overflow from the settling basin often is passed through a sand filter for the removal of particulate matter not settled out and the filtered effluent is then discharged to a tile field for percolation into the ground. The plant, when operating properly, produces a clarified effluent which can be absorbed into the ground far more readily than a septic tank effluent. It must be emphasized that a septic tank, when not overloaded, provides for liquification of the sewage solids with essentially no decrease in the total organics or suspended solids contents. The subsequent biological decomposition of the organics, when discharged by the septic tank to the tile field, can cause blinding of the soil matrix. This condition is not created with a well treated effluent from the aerobic process.

However, it is imperative that the stability of the treatment process be maintained at all times since, changing sewage flow rates and quality, will adversely affect the biological and settling process. Some manufacturers have provided surge tanks, but it has been difficult to counteract the conditions experienced at large municipal plants and this is much more uncontrollable with the household plant.

Historically, some of the plants for single households have been satisfactorily operated but require regular attendance, more freguently than recommended by the manufacturer. The effluent quality from the settling section fluctuates quite widely. The effluent quality on many occasions represents a treatment efficiency of only some 30-35% and some plants have required a start-up time of some 2-3 months. The effluent filtration system has improved the effluent quality but the long term life, in excess of one year, could not be predicted based on tests work conducted by the Ministry of the Environment on one particular plant. Mechanical failure of the plants has included plugged piping, as well as, blower and pump breakdowns.

It has been concluded that this type of treatment should only be considered as a replacement to the normal septic tank for those installations where public health problems now exist and there is insufficient land available for the installation of a conventional septic tank tile field system.

Installation of this system for new development should be considered only on the basis that each lot is sufficiently large to permit the installation of the tile field as described in the section relating to the septic tanks and tile fields. The basis for this recommendation is that, even with the satisfactory installation of an aerobic system and an adequate service contract with the initial homeowner, there is no assurance that the system will be operative many years into the future and that the subsequent owners will properly maintain the facility. Alternatively, consideration of such a system, with reduced lot area requirements, should be based on the municipal corporation assuming the maintenance and operational requirements, with the cost of the servicing collected in the form of taxes or special service levy.

The implication of such a policy is, of course, that the municipality is then obliged to maintain an adequate service to all residents similar to a municipal collection system, but with an individual sewage disposal system on each lot.

COMMUNAL SEWAGE SYSTEMS

1. Non-Effluent Systems - Septic Tank and Tile Fields:

Communal septic tank and tile field systems require the construction of a collector system to serve a group of houses, or a commercial area with outlet to a septic tank or aerobic biological plant. The effluent from the tank or plant would be directed to a tile field sized to accommodate the connected development. The tile field would be quite large and would have to be located on publicly owned land. Such a system could perhaps be considered for a cluster type development in which the land between the clusters is used for the construction of tile fields. The major drawbacks with this system are the need to construct very large tile fields, the need to utilize dosing chambers or pumping stations to periodically discharge a measured volume to a specific tile field area and topography of the land. Such a system requires regular inspection with the result that the operation costs are relatively high and there would be a need to ensure an adequate method for the collection of these costs from participating home owners. A condominium or municipal ownership would appear to be necessary.

It has been found that, when a development is proposed for a particular area, the water table and soil conditions, if unsuitable for the installation of individually owned services, are generally also not suitable for a communal system. An apparent advantage of a communal septic tank system could be the resultant isolation of the tile field from individual wells. It has been found that a communal water supply can be more economically constructed and maintained than the communal sewage system.

2. Waste Stabilization and Spray Irrigation:

Waste stabilization and spray irrigation systems can be considered where the area allows for the construction of the storage pond system with 7-8 months storage capacity and the spraying of the naturally treated sewage during the dry summer months onto land which is cropped. It is important that the management of these systems be emphasized because,

to operate satisfactorily, the rate of spray irrigation must be controlled to suit the crop and soil conditions. The vegetation and spray area may be either a type of forage, grain crop or bush. Proper operations have proven the system to be successful even on soils with a high clay content. At the same time, there have been cases where, despite ideal soil conditions, the system has failed due to improper management.

This system is known to be quite costly by comparison with satisfactory septic tank and tile field systems and it is suggested that it should be considered only where other alternatives, except for truck haulage, are not available to rectify the existing public health problems.

3. Effluent Systems:

All effluent systems require that a receiver with sufficient assimilative capacity be available to accept discharge of the treated effluent. Experimentation has been carried out to improve the effluent quality, however, the cost of such systems has prevented their use. Additionally, as the treated effluent has been improved either through biological or mechanical means, increasingly greater amounts of energy are required. Energy costs are expected to increase and will, therefore, tend to favour systems that do not require high treatment efficiencies.

Effluent systems include aerobic treatment plants of various types and modifications which may also provide effluent treatment for the removal of particulate matter, disposed organics or solids.

Activated sludge plants, complete with surge tanks, chemical treatment and effluent filtration provide a high degree of treatment with a continuous discharge. Reliably, it is expected that effluents with a BOD in the range of 5-10 ppm, and less than 1 ppm phosphorous are possible. Frequently, this process will provide a treated effluent with a BOD less than 4 ppm, but this cannot be attained under all plant operating conditions.

The standard waste stabilization pond with a 120-day storage time will provide short term flow regulation to the receiving stream, but not sufficient to prevent a discharge during the critical summer months. An intermediate degree of treatment is obtainable with an effluent BOD of approximately 50 ppm.

A third type of system that may be considered is a storage lagoon system operated on a fill and draw principle, utilizing chemicals to improve the removal efficiency of BOD, suspended solids and phosphorous. This system would discharge only during times of high flow in the receiving stream and consequently would be designed for a retention time of 240 days or 1 year, depending on the flow in the stream. The effluent from the pond can be expected to have a BOD of between 10-15 ppm and a phosphorous content of less than 1 ppm. It appears possible that this effluent could be improved somewhat, through the use of an effluent filtration system, but this has yet to be proven in a practical full scale installation.

INDIVIDUAL & COMMUNAL WATER SYSTEMS

1. Groundwater Supplies:

Individual and communal water systems that utilize the groundwater aquifer are limited by the recharge capability of the aquifer or its "safe yield". The average home will utilize approximately 360 gallons of water on a maximum day with no allowance for lawn watering. On this basis, an aquifer of an estimated capacity of 25 gpm (36,000 gpd) will be able to support a maximum of 100 homes.

A communal water system designed to provide the normal demands of a small community with storage facilities for fire protection and peak hour demands must have a pump tested long term capability of at least 0.5 gpm per home (720 gpd). Further, the well system, when operated at this rate, should not exceed a long term recharge capability of the aquifer. Consequently, a communal well system with a rated capability of 25 g.p.m. will be sufficient to supply only 50 homes. It should be noted that this discussion does not include the requirement

for lawn watering, standby well, or other facilities that would normally be necessary for communal well systems.

In summary, the use of a communal well system reduces by approximately 50%, the population that could be served by individual well systems on the same aquifer potential. This must be considered when the installation of a communal well is proposed to alleviate water supply problems in an area presently served by individual wells. In such an instance, the aquifer potential must be allocated to the existing development which is experiencing water shortages prior to considering any further growth.

A communal water supply must also be classed as potable in reference to provincial standards.

2. Surface Water Supplies:

Apart from the construction of a connection to the Region's water system, the only surface water sources in the Region are small rivers, none of which are satisfactory for use as a supply for domestic purposes, even with a treatment plant. Accordingly, for settlements where the groundwater aquifer is not adequate, the only alternative source of supply is the Hamilton water system.

DEVELOPMENT TYPE AND EXTENT

The discussion which follows is a general outline of the considerations relating to the development type and size based on a supply of adequate water and provision of satisfactory sewage disposal systems.

Settlements now experiencing public health problems have been assessed to determine the most suitable means to resolve these present difficulties. In the communities where it has been recommended that the Hamilton water and sewage systems be extended, the impact on the Hamilton system should be assessed prior to finalizing the development extent.

For settlements where the groundwater aquifer is to be utilized, either on an individual or communal well basis, it is the aquifer capability that will limit the ultimate size of the community. Accordingly, since different development types utilize varying quantities of water, a change to the type of development could result in an adjustment to the size of the community due to the aquifer limitations.

The locations and land area requirements for single family housing are dictated by the elevation of the groundwater table, soil type and terrain conditions. Sewage disposal utilizing septic tank and tile field systems should be utilized only for single family dwellings, as larger systems have generally not performed satisfactorily for an extended period of time. Large schools, restaurants, and laundromats are within this category. Small schools which offer only classroom teaching facilities and do not include cafeteria or showers for athletes, or small general stores of the merchandising type, can often be accommodated with individual septic disposal systems. Depending on the size of the settlement, the fire protection requirements could be reflected in the cost of fire insurance, particularly where significant high value districts exist in the community. The adoption of a requirement for large lots for single family dwellings, based on limitations imposed by the sewage disposal systems, assists in the separation of buildings with a significant reduction in the possibility of the spread of a fire to adjoining strucutres.

It is believed that the rate of growth of a settlement, in the past has also indirectly affected the resultant servicing conditions. The result is an overloaded septic tank system in addition to the dry well. It appears that in those settlements where the growth rate has been very nominal, a few homes per year, the new residents are made aware of the servicing limitations due to the closeness of longtime residents or neighbours, before problems occur, and adopt an attitude similar to the present residents. Also, large developments do not promote the exchange of information of the existing community to the same extent. All new residents are neighbours to each other and continue with previously adopted attitudes, concerning

unrestricted use of water and sewage systems, acquired when living in a municipality with communal water and sewage works. It is, therefore, suggested that, if additional development potential of, say, 100 new homes is identified, this development could proceed at a maximum rate of 4 - 5 new homes per year. Such a rate of growth would resolve the past difficulties with large subdivisions and allow adjustment to the policies related to land use and servicing needs that may be dictated by future life styles.

The shape of the building lot also affects the suitability of the lot for the construction of an adequate tile field system. A lot which has a relatively narrow street frontage with considerable depth; i.e. 100 ft. frontage and 400 ft. depth, is far more suitable for the construction of a tile field in the back yard, than a lot with dimensions 200 ft. x 200 ft. Further, it is possible to achieve greater separation of the tile field from the wells, in particular, neighbouring wells.

APPENDIX 'B'

GLOSSARY OF TERMS

AQUIFER	A porous water bearing geologic formation. Generally restricted to materials capable of yielding an appreciable supply of water.
DRUMLIN	A long oval mound or drift of diluvial formation.
ESKER	A long winding gravelly ridge deposited by a stream flowing in a channel in the ice of a glacier or below the glacier.
KAME	A short ridge or irregular hummock of gravel and sand piled up by a glacial stream flowing from beneath, from within, or over the top of a glacier, generally between the ice and a lateral or terminal moraine.
LACUSTRINE	Laid down underwater in the bed of a lake, as sedimentary deposits.
LACUSTRINE PLAIN	A plain originally formed as the bed of a lake from which the water has disappeared.
MORAINE	A mass of material deposited by a glacier in the process of melting.
PERCOLATION	The movement or flow of water through the interstices or pores of a soil or other porous medium.
PERMEABILITY	The property of a material that permits appreciable movement of water through it when it is saturated. The movement is caused by hydrostatic pressure encountered in natural subsurface water.

TILL — Deposits of glacial drift laid down in place as the glacier melts. These deposits are neither sorted nor straitified and consist of a heterogenous mass of rock flow, sand, pebbles, cobbles and boulders.

APPENDIX 'C'

The Soil Unit references on the legend of individual Community Plans. Plans 4 through 22 are described as follows:

Unit 1 - Organic Soils:

Wet swampy areas with poor drainage and high water table. Surficial soils are organic generally less than 10 ft. thick, but the larger swamps could have more than 20 ft. of organic material.

Unit 2 - Clays:

These are lacustrine silty clays.

Unit 3 - Silts:

Major portion of soil is silt size particles, but there will be a minor sand content and possibly a clay content.

Unit 4A- Fine Granular Soils:

Coarse silts to fine sands.

Unit 4B- Coarse Granular Soils:

Coarse sands to gravel with possibly some cobbles and boulders.

Unit 5 - Clay Till:

Largely compacted silty clay with an average of 10% to 20% stone content.

Unit 6 - Granular Till:

Large silt content with 40% or more of sand, gravel, cobbles and boulders.

Unit 7 - Shallow Granular Till over Bedrock:

Generally less than 5 ft. and sometimes as little as 1 ft. of sandy till over bedrock.

Areas with suffix 'C' are low-lying, poorly drained and subject to a high water table condition. Unlike Unit 1, there is little or no surface organic material (generally less than 3 ft.)

APPENDIX 'D'

SERVICING OPTIONS FOR BINBROOK

As discussed within the "Settlement Reports" Section of the main body of the report, the settlement of Binbrook has attained a population level where it is begining to exhibit polluted groundwater sources as evidenced by high bacteriological counts in many wells within the community.

The Township of Glanbrook Council have expressed interest in the possibility of Binbrook expanding to an ultimate population of 20,000 persons. This apparent desire combined with the existing water supply problems requires that full municipal services be considered for servicing the existing and expanded community.

Three servicing options have been considered for expansion of Binbrook to the population level of 20,000 persons and include only the major trunk sewer and watermain facilities. Local collection sewers and distribution watermains have not been included in the following estimates since the location and size of those facilities is dependant upon detailed land use planning and servicing considerations:

OPTION 1) Connection to Regional Sewer and Water Systems.

Provision has been made in the sanitary sewer and watermain systems for expansion within the Township of Glanbrook, up to an equivalent population of 20,000 persons. While initially intended for growth within a gravity draining service area immediately south of the City of Hamilton limits, the sanitary sewer allocation could be utilized for residential growth at the expense of the development originally provided for. Ground elevations in and around Binbrook, necessitate pumping of sewage from any Binbrook-centred growth into the Hamilton sanitary sewer system. The precise connection points to the

Regional Sanitary Trunk Sewer will depend upon the timing of any proposed connection to the system since the Region is presently designing extensions to the existing system.

SEWAGE DISPOSAL

(1) 24" ø Trunk Sewer (Centre of Binbrook to Twenty Mile Creek)	$ 400,000
(2) Pumping Station 8 M.G.D. station with standby power	$ 400,000
(3) 12"ø Forcemain (Pumping station to gravity discharge)	$ 550,000
Total: Estimated Probable Construction Cost to service 20,000 people on sanitary trunk sewers discharging to Hamilton system -	$1,350,000

WATER

(1) 24"ø Supply Main	$1,100,000
(2) 0.6 M.I.G. Elevated Storage	$ 600,000
Total: Estimated Probable Construction Cost to provide piped water -	$1,700,000

TOTAL: OPTION 1, Estimated Probable Servicing Costs-	$3,050,000

OPTION 2) Water supply from Hamilton System and Sewage Treatment Facility at Welland River with 6 month Storage - Seasonal Discharge.

The proposed treatment facility considered under this option, to accommodate sewage flows from a total population of 20,000 persons includes aerated lagoons, 6 month storage of sewage flows, and controlled discharge during the spring and fall months.

SEWAGE DISPOSAL

(1) 24"ø Trunk Sewer (Centre of Binbrook to Welland River Site)	$ 800,000
(2) Treatment Facility at Welland River	
Pre-aeration Chambers	$ 380,000
Oxidation-Retention Ponds	$1,500,000
Alum Dosing Chambers	$ 50,000
Total: Estimated Probable Construction Cost to service 20,000 people with sanitary sewers and treatment facility -	$2,730,000

WATER

(1) As with Option 1	$1,700,000

TOTAL: OPTION 2,

Estimated Probable Servicing Costs-	$4,430,000

OPTION 3) Water Supply from City of Hamilton System and Sewage Treatment Facility at Welland River with 100 day Storage - Continuous Discharge or Summer Holding.

The proposed treatment facility considered under this option to accommodate sewage flows from a total of 20,000 persons includes 100 day storage of sewage flows, extended aeration and effluent filtration with continuous discharge. Storage capacity is provided to accommodate very low flows in the receiving stream.

SEWAGE DISPOSAL

(1) 24"ø Trunk Sewer (Centre of Binbrook to Welland River Site)	$ 800,000

(2) Treatment facility at Welland River S.T.P.	$2,000,000
Retention Pond	$ 110,000
Total: Estimated Probable Construction Cost to service 20,000 people with sanitary trunk sewers and treatment facility-	$2,910,000
WATER	
(1) As with Option 1	$1,700,000
TOTAL: OPTION 3, Estimated Probable Servicing Costs-	$4,610,000

SUITABILITY OF THE WELLAND RIVER AS A RECEIVING STREAM

A flow gauging station is located on the Welland River, at Merritts Church, approximately 15 miles east of Binbrook. The drainage area tributary to the river at Merritts Church is approximately 87 square miles which is compared to a drainage area of 23 square miles, upstream from Binbrook. The pertinent flow conditions in the Welland River at Merritts Church have been reviewed and it is noted that the average annual river discharge in 1972 and 1973 was approximately 74,000 acre feet as compared to approximately 50,000 acres feet for the previous year of record.

The Binbrook Reservoir was placed into operation in 1972, but, it appears that the higher than normal flows following the construction of the reservoir are due to higher precipitation rather than the construction of the reservoir.

The following table lists the Mean and Minimum Flow Conditions in the Welland River at Merritts Church and the estimated condition at Binbrook.

Year	Flow Condition	Flow At Merritts Church cfs	Estimated Flow At Binbrook cfs
1971	Mean Flow	48.8	12.9
	Min. Flow	0	0
1972	Mean Flow	123	32.5
	Min. Flow	3.8	1.0
1973	Mean Flow	108	28.6
	Min. Flow	4.7	1.2

The above table indicates the effectiveness of the reservoir in maintaining summer flow in the river.

No data was available on the water quality existing in the River.

The assimilation capacity of the river at Binbrook cannot be accurately estimated with presently available data. A flow gauging and sampling station should

be installed to record the present conditions. The data obtained from such an installation may not be sufficient to indicate the capacity of the river to assimilate a treated effluent, but it would enable an initial assessment of the merits in continuing with a comprehensive study of the river.

In summary, the cost comparison, as presented, should be assessed to determine if the estimated high cost options with discharge to the river are to be considered further. Should it be decided to consider one of the options with discharge to the Welland River, additional information on the River would be required to determine the viability of the project.

The following tabulation is an outline of the cost impact on the average homeowner for each alternative:

Alternative	Capital Cost	Cap. Cost $/1000 gal.	Sewage Treatment Cost $/1000 gal.	Av. Homeowner Cost $/1000 gal.	Av. Annual Homeowner Cost *
1. Water & Sewage Connection to Hamilton system	$3,050,000	.42	.25	.67	$75.
2. Water from Hamilton Sewage Storage lagoons discharging to Welland River	$4,430,000	.61	.15	.76	$85.
3. Water from Hamilton Sewage Treatment and discharge to Welland River	$4,610,000	.63	.20	.83	$92.

* Exclusive of collection system costs.

APPENDIX 'E'

COMMUNAL WATER SUPPLY

The provision of small communal water systems, to serve a cluster or group of houses, has the advantage that an adequate potable water supply can be made available in some areas where it is difficult to locate a number of individual wells. However, subsequent to the construction of such a system that is owned by a group of residents, many financial difficulties have arose. These difficulties have been mainly related to the lack of ability to force payment of bills by all users. In situations where the issue is difficult or costly to resolve, the service has generally been allowed to become increasingly difficult to maintain, often to the point where the individual resident has initiated the construction of a separate supply. The problem can be effectively overcome through municipal ownership. To accomplish this requires a clear definition of the works to be owned by the municipal corporation including access, restoration of property, etc.

Many alternative maintenance arrangements have been attempted, but from experience, difficulties that have occurred in the maintenance of the service have only been resolved through involvement by the Municipal Corporation. Accordingly, any system requiring the approval of the Ministry of the Environment, is now considered by this Ministry only on the basis that the municipality will own and maintain the facility. Similar problems have occurred in the past when private roads were constructed to serve a housing development.

We are not aware of any situation where the Municipal Corporation has adopted an arrangement whereby financial assistance is provided to a group of residents to pay for the repairs or system expansion, on the basis that the money is repaid through an additional impost on the municipal tax assessment.

On the above basis, it is suggested that the Region should only consider individual or Regionally owned water systems.

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